A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE

A THESIS SUBMITTED TO THE BABA FARID UNIVERSITY OF

HEALTH SCIENCES, FARIDKOT (PUNJAB)

FOR THE AWARD OF DEGREE OF

MASTER OF SURGERY

IN

GENERAL SURGERY

BY

DR. INDERPEET SINGH

SUPERVISOR

DR. MUNISH TREHAN

DEPARTMENT OF GENERAL SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA
(MAY, 2020)

DECLARATION

I declare that the thesis entitled "**A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE**" has been prepared by me under the guidance of **Dr. Munish Trehan**, Associate Professor, Department of General Surgery, Dayanand Medical College and Hospital, Ludhiana. No part of this thesis has formed the basis for the award of any degree previously.

_____

Dr. Inderpreet Singh
Department of General Surgery
Dayanand Medical College & Hospital
Tagore Nagar
Ludhiana-141001
Punjab.

Date:

CERTIFICATE

I certify that **Dr. Inderpreet Singh** has prepared his thesis entitled "**A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE**" for the award of the degree of M.S. in General Surgery of Baba Farid University of Health Sciences, under my guidance. He has carried out the work at the Department of General Surgery, Dayanand Medical College & Hospital, Ludhiana.

Supervisor

Dr. Munish Trehan
Associate Professor
Department of Surgery
DMC&H, Ludhiana

Co- supervisor(s)

Dr. Jaspal Singh
Professor & Head
Department of Surgery
DMC&H, Ludhiana

Dr. Sanjeev Singla
Professor
Department of Surgery
DMC&H, Ludhiana

Date:

ENDORSEMENT BY THE HEAD OF THE DEPARTMENT AND PRINCIPAL

This is to certify that the thesis entitled "**A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE**" is a bonafide research work done by **Dr. Inderpreet Singh** under the guidance of **Dr. Munish Trehan**, Associate Professor, Department of General Surgery, Dayanand Medical College & Hospital, Ludhiana.

Head of Department

Dr. Jaspal Singh
Professor & Head
Department of General Surgery
DMCH, Ludhiana

Principal

Dr. Sandeep Puri
Principal & Professor
DMCH, Ludhiana

Date:

COPYRIGHT

Declaration by the Candidate

I hereby declare that the Baba Farid University of Health Sciences, Faridkot, shall have the rights to preserve, use and disseminate this thesis in print or electronic format for academic/research purpose.

Dr. Inderpreet Singh
Department of General Surgery
Dayanand Medical College & Hospital
Tagore Nagar
Ludhiana-141001
Punjab.

Date:

© Baba Farid University of Health Sciences, Faridkot

Dedicated

to

my family

&

Teachers

ACKNOWLEDGEMENT

"As we express our gratitude, we must never forget that the highest appreciation is not to utter words, but to live by them."

First and foremost, praises and thanks to almighty, for showering His blessings that helped me accomplish this work. I thank him for everything and for blessing me much more than I deserve. The good and bad. Some were blessings and some were lessons.

The mediocre teacher tells

The good teacher explains

The superior teacher demonstrates

The great teacher inspires

It is my proud privilege to express my gratitude and indebtness to my esteemed teacher and elite supervisor Associate Prof. ***Dr. Munish Trehan****, for providing invaluable guidance throughout this work. His vision, sincerity and motivation have deeply inspired me. I thank him for his patience and timely advice, without which I would have floundered in this study. It is indeed my extraordinary privilege to be able to work under his expert guidance. His boundless expression of knowledge has gone a long way in ensuring the completion of this study. I am privileged to be associated with him as a student. The curriculum is the so much necessary raw material, but warmth is the vital element for the growing plant and the soul of the student. I will always be proud of the fact that once, I was his student.*

A good teacher can inspire hope, ignite the imagination and instill a love of learning.

I owe a debt of gratitude to my esteemed Co-supervisor, ***Dr. Jaspal Singh****, Professor $ Head Department of surgery DMCH Ludhiana for broadening my horizon and for his invaluable suggestions throughout the course of the study,*

which exceptionally inspired me as a student and a researcher. I am grateful to my Co-supervisor, ***Dr. Sanjeev Singla*** *Professor, Department of surgery, Dayanand Medical College and Hospital, ludhiana for their cooperation and help in the completion of this work. This dissertation would not have been possible without the guidance of several individuals who in one way or another contributed and extended their valuable assistance in preparation and completion of this study.*

"Behind every son who believes in himself, are the parents who believed first." With this saying, I am eternally indebted to my parents ***Mr. Mohinder Singh and Mrs. Parkash Kaur*** *for their valuable support that I have received throughout my life and for believing in me. I place all the credit of my success and achievements in their holy feet .And the contributions of my better half* ***Dr.Karanpreet Kaur*** *couldn't be explained in words; as she guided me with best of her knowledge through every thick & thin during this period of residency.*

I owe my thanks to my friends and colleagues for their endless patience and support at every possible step in the course of this study. I am sincerely thankful to ***Dr. Rohit Jindal,*** *Sr. resident; who has always been generous with help and advice in the course of this study. Of course, this work would not have been possible without the participation of the patients. I express my gratitude to all the patients for their cooperation.*

I acknowledge the help of all those invisible hands who are responsible for the successful outcome of this desertation.

Dr. Inderpreet Singh

ABBREVIATIONS

SWD	Surgical Wound Dehiscence
AWD	Abdominal Wound Dehiscence
SSI	Surgical Site Infection
HAI	Health Associated Infections
SSTI	Skin and Soft Tissue Infection
WUWHS	World Union Of Wound Healing Societies
VAS	Visual Analogue Score
NR	Non Responder
NCR	Non Complete Responder
PR	Partial Responder
CR	Complete Responder
NS	Non Significant
S	Significant
EM	Emergency operation
EL	Elective opeartion
T	Transverse operation
V	Vertical incision

ABSTRACT

Introduction: Post Operative wound dehiscence also known as surgical site infections (SSI's) wound dehiscence can cause painful lengthy hospital stay, multiple stages of surgeries, permanent disabilities, prolonged rehabilitation. To tackle these tissues, wound dressing plays a important role collagen is an endogenous substance which appears to be a good material for use as biomedical implantable device & which forms a matrix for regenerating tissue.

Aim of Study: a) To compare standard vs collagen dressings in postoperative abdominal wound dehiscence. b) To document the outcome of patients with post operative abdominal wound dehiscence. c) To study the type of incision leadng to wound dehiscence. d) To study the incidence of wound dehiscence in elective and emergency operation.

Materials & Methods: Information will be collected via predesigned proforma, complete clinical examination will be done & wound perimetry will be analysed in control & test group in this comparative study (extending from Dec 2017 to Dec 2019). All patients with post operative abdominal wound dehiscence after any abdominal incision in a age group between 15 to 60 years will be included. Patients unwilling for study or more 60 years as less than 15 years & patients who are hypersensitive to collagen are excluded.

Results*:*.Collagen dressings are significantly better and more efficacious then standard dressings in post operative wound dehiscence .Healing response & final outcome in post operative abdominal wound dehiscence is dependent on multiple factors low Hb, high TLC, obesity and low S.Albumin levelsand associated comorbidities disrupts healing process and delays the wound healing. There is no definite type of incision which leads to wound dehiscence and there is more incidence of wound dehiscence in emergency operations.

Conclusion : Collagen dressings plays a pivotal role in healing process in post operative abdominal wound dehiscence whereas standard dressings are less efficacious in wound dehiscence .

Keywords: Abdominal wound dehiscence, Post operative dehiscence, collagen dressings, wound dehiscence, surgical site infections, collagen dressings outcome.

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-5
II	AIMS AND OBJECTIVES	6
III	REVIEW OF LITERATURE	7-28
IV	MATERIAL AND METHODS	29-33
V	OBSERVATIONS AND RESULTS	34-49
VI	DISCUSSION	50-54
VII	SUMMARY AND CONCLUSION	55-56
VIII	BIBLIOGRAPHY APPENDICES – I - PROFORMA - MASTER CHART	57-64
	APPENDICES – II - APPROVAL LETTER OF THESIS PLAN - THESIS PLAN	

LIST OF TABLES

Table No.	Title	Page No.
1	Age Distribution	34
2	Sex Distribution	36
3	Comparison of other variables	37
4	Time of dehiscence	39
5	Comparison of wound size in both groups on day 1	40
6	Comparison of wound size in both groups on day 28	41
7	Distribution according to healing response on day 1st	42
8	Distribution according to healing response on day 7th	43
9	Distribution according to healing response on day 14	45
10	Distribution according to healing response on day 28	47
11	Distribution according to type of incision	48
12	Distribution according to type of surgery: Elective v/s Emergency operation	49

LIST OF FIGURES

Fig. No.	Title	Page No.
1	Mean age of patients (in years)	35
2	Age distribution of patients (in years)	35
3	Sex distribution in study and control group	36
4	Mean Hb (g/dl)	37
5	Mean TLC	38
6	Mean S. Albumin (g/dl)	38
7	Time of dehiscence	39
8a	Comparison of wound size in both groups (mm^2)	40
8b	Comparison of wound size in both groups (mm^2)	41
9	% of patients in Non Responder category	42
10	Distribution according to healing response on day 7^{th}	44
11	Distribution according to healing response on day 14	46
12	Distribution according to healing response on day 28	48
13	Distribution according to type of surgery	49

LIST OF PICTURES

Pic. No.	Title
1	Wound status on day 1 of collagen dressing
2	Wound status on day 1 standard dressing
3	Wound status on day 28 after collagen dressing
4	Wound status on day 28 after standard dressing

INTRODUCTION

Abdominal wound dehiscence is one of the most alarming complication which the surgeons are facing from decades. It is defined as the disruption of wound occurring mostly between 5th to 8th post-operative days. Wound dehiscence represents as partial or complete disruption or breakdown of an abdominal wound closure with or without protrusion of abdominal contents.[1] Dehiscence of the wound after abdominal surgery is a serious complication that continues to trouble the surgeon and threaten the patient. In other words wound dehiscence is the separation of the edges of a surgical wound. It may involve the surface layer or the whole wound. It may pose a serious complication and may contribute to the deterioration of the patients general condition.[2]

Wound dehiscence is particularly common after abdominal surgery, and can be divided into two clinical entities:[3]

- **Superficial dehiscence** – the skin wound alone fails to heal, often secondary to infection, poorly controlled diabetes mellitus, or poor nutritional status.
- **Full thickness dehiscence** – the rectus sheath fails to heal and bursts, with protrusion of small bowel and omentum often termed as burst abdomen. It may occur due to raised intra-abdominal pressure, poor surgical technique such as poor suture technique or poor suture choice or if the patients is critically unwell.

Wound healing is complicated process involving a number of chemical and biological events. Wound dehiscence being addressed by various names interchangeably, like burst abdomen, wound failure, wound disruption, is a multifactorial process. The understanding of wound healing and dehiscence are complicated by the fact, that it is uncommon for any single factor to exist in isolation and to determine which factor is of greatest importance in a particular case.[4,5] Surgical incisions stimulate the healing cascade, which is a complex and continuous process having four different stages:[6,7]

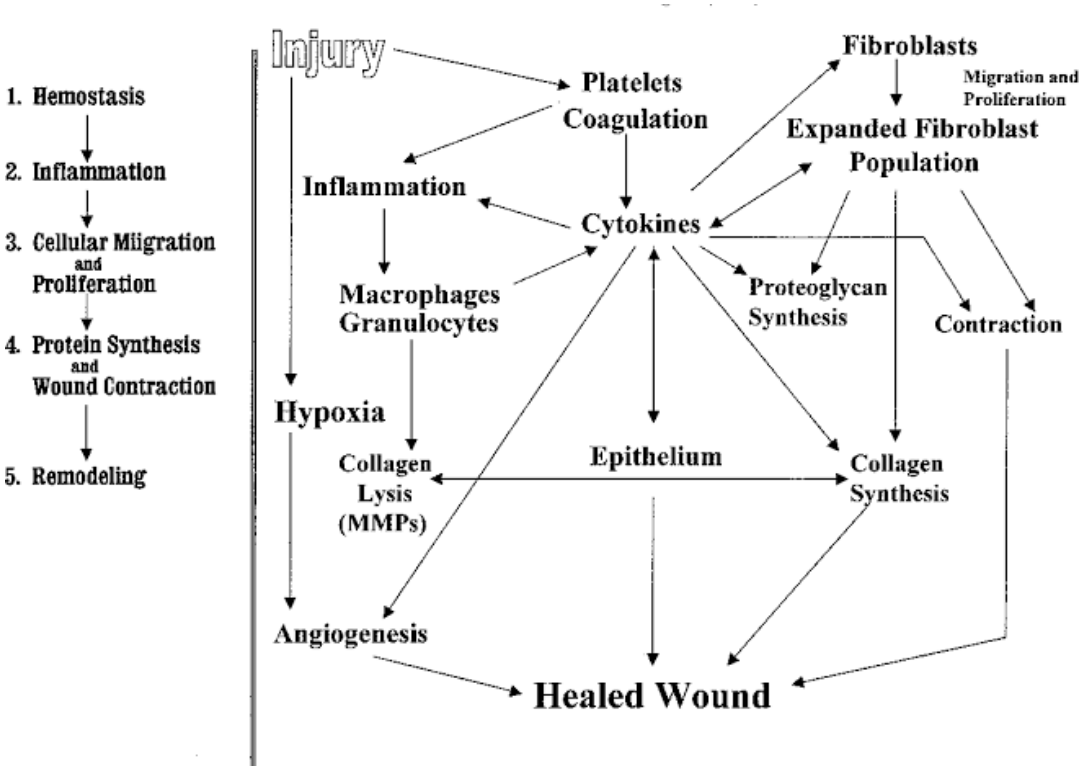
1) Hemostasis
2) Inflammation
3) Proliferation
4) Maturation

During hemostasis, platelets aggregate, degranulate and activate blood clotting. The clot is degraded, the capillaries dilates and fluids flow to the wound site, activating the complement cascade. Macrophages, lysis of cells and neutrophills are a source of cytokines and growth factors that are essential for normal wound healing. In a vascular inflammatory response, the lesioned blood vessels they start contracting and the leaked blood coagulates, leading to the maintenance of its integrity.[6-8] The coagulation process consists of an aggregation of thrombocytes and platelets in a fibrin network, relying on the action of specific factors through the activation and aggregation of these cells. Cell response in the inflammatory stage is characterized by the influx of leukocytes at the site of wound. This response is very fast and coincides with the key signs of inflammation, which are revealed by the edema and the erythema at the location of the lesion. Normally, cell response is established during the first 24 hours and can extend for up to two days.[7,8]

The proliferation phase in which the granulation tissue forms in, the wound space contraction begins on the 3rd postoperative day and lasts for several weeks. The aim of the proliferative stage is to minimize the lesioned tissue area by contraction and fibroplasia, establishing a viable epithelial barrier to activate keratinocytes. This stage is responsible for the closure of the lesion, which includes the role of other processes such as angiogenesis, fibroplasia, and re-epithelialization. These processes starts in the microenvironment of the lesion within the first 48 hours and can unfold up to the 14th day after the onset of the lesion. The most important factor in this phase are fibroblasts which move to the wound and are responsible for the collagen synthesis. The maturation phase begins on the 7th postoperative day and lasts for 1 year or more, continued collagen

deposition and remodeling contribute to the increased tensile strength of wounds.[9,10]

The diagramatic representation of wound healing cascade:



Surgical Wound Dehiscence (SWD) can have a negative impact on patient's mental health as well as on physical and social functioning.[11,12] Mortality following abdominal SWD can also be high at 3%–35%, Furthermore, patients with abdominal SWD have a high risk of incisional hernia of up to 83%.[11-13] In patients with abdominal incisions, mechanical stress may also arise from various activities that cause a sudden increase in intra-abdominal pressure, such as retching, vomiting, coughing, sneezing and lifting heavy weight. Raised intra-abdominal pressure may also occur post abdominal surgery and, if it is sufficiently high, it may compromise organ function leading to abdominal compartment syndrome and contribute to abdominal wound dehiscence. The wound dehiscence can cause painful long hospital stay, multiple stages of surgeries, permanent disability, prolonged rehabilitation.[14-16]

Therefore, in order to handle these issues wound dressings plays one of the important roles. It is mandatory that the process and problems of wound healing should be vigorously addressed by all practitioners.

An ideal dressing used in the wound management should be economical, easy to apply, readily available dressing or method that will provide good pain relief, protect wound from infection, promote healing, keep moisture, be elastic and non antigenic and adhere well to the wound . The waiting for spontaneous epithelization and healthy granulation among newer type of wound dressings- Biological dressings like collagen create the most physiological interface between the wound surface, environment and impermeable to bacteria.[17-19]

Collagen is an endogenous substance, which appears to be a good material for use as a biomedical implantable device and is used to form a matrix for regenerating tissue outside of the body. Collagen dressing has better advantage over conventional dressing in terms of collagen formation with greater reduction in inflammatory cells during healing days, whereas conventional dressing has minimal exudates formation resulting in increased days of healing.[20]

Collagen serves as important extracellular component for repair of skin tissue. Various beneficial features of collagen that promotes wound healing are as follow:[21,22]

1) Chemotactic properties
2) Hemostasis
3) Promotion of granulation and angiogenesis
4) Enhances fibroblastic activity
5) Assists reepitheliazation
6) Scar size reduction

COLLAGEN AND WOUND HEALING PROCESS:

Wound healing is complicated process which encompasses various overlapping stages which involves mainly the role of collagen. Collagen proteins are the most abundant family of proteins found in humans. 70%

of the dry weight of the skin is collagen. Hemostasis is the first step during wound healing. Blood platelets and various clotting factors play important function as intravascular hemostatic factors. Platelets initiate hemostasis and also release large number of biologically active substances which includes extracellular matrix molecules such as fibronectin, fibrinogen, thrombospondin and growth factors. Collagen is very efficient hemostatic agent as platelets adheres to collagen, swell and release substances that initiate hemostasis. Collagen is a molecule of sufficient size for platelet aggregation.[23,24]

Hemostasis is followed by vascoconstriction and vasodilatation. Vasoconstriction continues approximately 1 hour after injury which is followed by debridement or cleaning of wound. Collagen helps in cleaning the wound by causing marked reduction in number of neutophils present at the wound site. Following debridement collagen enhances granulation and angiogenesis by increasing the number of macrophages and fibroblasts.[25]

The fibroblastic phase provides strength to wound and lasts approximately 4 days to 20 days in duration. The activity of fibroblasts governs the restoration of the tissue continuity and strengthening of ensuing repair tissue. Fibroblasts adhere effectively to collagen. Therefore collagen is involved in one of the major wound healing events that is migration of fibroblasts.

In view of paucity of literature on comparison and use of collagen and standard dressings in abdominal wound dehiscence, the purpose of present study is to compare efficacy of conventional versus collagen dressings in abdominal wound dehiscence.[26]

This study has been conducted in the department of General Surgery in Dayanand medical college and Hospital had reviewed the management and outcome of patients with diagnosis of post operative abdominal wound dehiscence.

AIMS AND OBJECTIVES

1) To compare standard vs collagen dressings in postoperative wound dehiscence.
2) To document the outcome of patients with postoperative abdominal wound dehiscence.
3) To study the type of incision leading to wound dehiscence.
4) To study the incidence of wound dehiscence in elective and emergency operation.

REVIEW OF LITERATURE

History of wound healing can be traced back to the time immemorial. The history of wound healing is in fact the history of gradual understanding of process of wound healing and method of treating them. Availability of dressing often provides some physical protection and to some extent helps to absorb exudates. Wound dehiscence is a mechanical failure of wound healing, remains a problem and it can be affected by multiple factors. The normal wound healing process has been identified as involving three overlapping major phases:[10]

- In first inflammation, with cascades of processes that can further subdivided into early (first 24 hours) and late phase (upto 72 hours)
- Regeneration
- Maturation

The development of wound dehiscence depends on contamination of wound at end of surgical procedure and specifically relates to pathogenecity and inoculum of microorganisms present, balanced against the host's response. The microorganisms that are responsible for delayed wound healing are usually derived from patient (endogenous infection). Staphylococcus aureus is the most commonly responsible organism.[27]

The proper wound healing demands oxygen consumption, normoglycaemia and absence of toxic or septic factors, which reduces collagen synthesis and oxidative killing mechanisms of neutrophils. Wounds heal by primary, secondary or tertiary intention. Wounds that approximated heal by primary intention by deposition of connective tissue which is necessary to fill the wound.

Timely and sustained postoperative wound healing plays a significant role in optimising a patient's postoperative recovery and rehabilitation.[28-30] It has been established that surgical wound dehiscence (SWD) contributes to increased morbidity and mortality rates, and implicit and explicit costs for individuals and health care providers. Explicit costs result from

prolonged hospitalisation, the need for community nursing and the use of wound management consumables.[31]

Review on the subject of comparison of standard dressings vs collagen dressings in abdominal wound dressings shall be discussed under the following headings:

1) Epidemiology
2) Etiology
3) Risk factors of wound dehiscence
4) Clinical features
5) Identification/ grading of wound dehiscence
6) Assessment of wound
7) Role of various dressings in management
8) Studies

EPIDEMIOLOGY OF ABDOMINAL WOUND DEHISCENCE:

Overall, it is estimated that wound dehiscence occur following 1%–3.1%[32] of all surgical procedures and account for approximately 2.0% of deaths due to health related infections. In association with abdominal surgery, the rate of wound infection may be much higher, with several prospective studies reporting an incidence of 15%–25% depending on the level of contamination.[33,34]

A recent study reviewing the reasons for hospital admissions after surgery in the USA demonstrated that SSI was the most common reason for unplanned readmission (19.5% overall, 25.8% following colectomy / proctectomy) followed by obstruction/ ileus (10.3% overall). When considering HAIs, survey data gathered by 183 acute-care hospitals in 2011 estimated that 157,500 of 721,800 (21.8%) cases were due to SSIs. Compared to other common nosocomial infections, SSIs (21.8%) and pneumonia (21.8%) were the most commonly reported, followed by gastrointestinal (17.1%), urinary tract (12.9%), and bloodstream infections (10.0%). The number of SSIs reported is likely an underestimate of the true incidence, as many are diagnosed in an outpatient setting or after

discharge. In general, the rate of SSI for men appears to be higher than that of women across several studies.[35-37]

Nationally, 91,613 readmissions due to SSIs were reported in 2005, and overall associated hospital costs exceeded $900 million. Moreover, from 1993 to 2005, the number of emergency department visits in the USA for skin and soft tissue infections (SSTIs) increased from 1.2 million to 3.4 million. Of all emergency department visits, SSTIs constituted 1.35% in 1993, increasing to 2.98% in 2005.[38] A separate study demonstrated that between 2000 and 2004, total hospital admissions increased by 29% for SSTIs. Similar trends are highlighted at the state level. In North Carolina, the most common HAIs are SSIs (73%), and related costs approximated 87%–91% of the total HAI related expenditure. These excess costs are largely related to antimicrobial/drug treatment, interventions, and additional nursing care.[38,39]

ETIOLOGY OF WOUND DEHISCENCE:

Various causes have been implicated in the etiology of abdominal wound dehiscence. These causes may vary depending on the type of surgery. The causes of SWD can be categorised as:[40-42]

- Technical issues with the closure of the incision – e.g. unravelling of suture knots.
- Mechanical stress – like coughing can cause breakage of the sutures or rupture of the healing incision after suture or clip removal/reabsorption.
- Disrupted healing – due to comorbidities or treatments that hamper healing, or as a result of a surgical site infection.

TECHNICAL ISSUES: Wound Dehiscence (WD) may occur because of technical issues associated with the closure of the incision and type of the incision (vertical or transverse). Surgical incisions are closed to bring together the sides of the wound to initiate the healing and minimize scar formation. Surgical incision closure is achieved with sutures, staples, adhesive tapes or tissue adhesives. The most appropriate closure material and technique for a surgical incision depends on a wide variety of factors

including the number of tissue layers to be closed, the anatomical location of the incision, the condition of the patient, and surgeons preference. WD may occur if the method of incisional closure fails or is not strong enough to hold the edges and sides of the incision together.[40]

MECHANICAL STRESS: Mechanical stress placed on a closed surgical incision can cause WD by disrupting the material used for closure or by rupturing the healing tissues. Mechanical stress can result from excessive forced tension during wound closure or swelling of the tissues around the incision due to oedema. Mechanical stress may also be due to a haematoma, seroma or abscess below the surface of the incision.[40,41]

DISRUPTED HEALING: The complex process of wound healing in a closed surgical incision (known as healing by primary intention) can be divided into four distinct, necessary, but overlapping, phases: haemostasis, inflammation, proliferation and remodeling. Any complication or factors disrupting these phases or impair their normal functioning can lead to disruption of process of healing ultimately landing up with wound dehiscence.[42,43]

Over all some of the common factors playing role in causation of wound dehiscence include:[44]

- Infection at the wound site
- Pressure on sutures
- Tight sutures
- New injury to the area
- Weak tissue or muscle at the wound area
- Incorrect suturing at time of surgery
- Use of high-dose or long-term corticosteroids

RISK FACTORS FOR WOUND DEHISCENCE:

The most common cause of wound dehiscence is infection. This is the reason why early identification and treatment of any surgical site infection or wound disruption is important. Although it is clear that some dehisced wounds are not due to infection, rates of infection in dehisced wounds are

infrequently reported. In addition, infection can develop in a dehisced wound also. Wound dehiscence can result from various etiological factors that can lead to wound disruption singly or in combination. Not only etiological factors but there are several risk factors also that can hamper the normal process of wound healing.[45-47]

The risk factors for wound dehiscence are listed in Table:[46-48]

Patient Factors	Intra-Operative Factors	Post-Operative Factors
• Increasing age • Male gender • Co-morbidities, especially DM • Steroids • Smoking • Obesity or malnutrition	• Emergency surgery • Abdominal surgery • Length of operation (>6hrs) • Wound infection • Poor surgical technique	• Prolonged ventilation • Post-operative blood transfusion • Poor tissue perfusion (e.g. post-operative hypotension) • Excessive patient coughing • Radiotherapy

Several studies have identified various factors associated with SWD, such as age, gender, ascites, jaundice, cardiovascular disease, pneumonia and infection and have sought to identify associations between patient comorbidities and SWD across specific surgical domains. These factors plays an important role in the background of set up of wound dehiscence.[49]

Emergency surgery is also considered as a risk factor for the development of abdominal wound dehiscence since many factors contributes to this, such as presence of intra-abdominal sepsis, presence of uremia, presence of renal failure, presence of malnourishment, anemia, requirement of intestinal stomas, increased intraabdominal tension.

Patients with a body mass index (BMI) (kg/m2) in the normal range (18.5–24.9) have lower SSI rates when compared to patients in the overweight and obese BMI categories.[49] A BMI of 30 is associated with increased likelihood of developing a SSI, and this relationship strengthens with increasing BMI. Smoking decreases tissue oxygenation, which in turn increases the risk of wound infection.[50-52] Whereas several studies have suggested that current smoking status (within a year of surgery) significantly increases the risk of all SSIs, others note an increase in deep/organ space infections, but not superficial SSIs. Preoperative sepsis is associated with developing an organ space SSI, but not superficial or deep infections. This is likely explained by resultant poor tissue perfusion/oxygenation, as well as bacterial spread from the bloodstream. Previous abdominal surgery has been shown to be associated with increased risk of any SSI, including deep or organ space infections.[49,50]

Diabetes mellitus has been said to have effect on all stages of wound healing. It causes atherosclerosis of the vessels and leads to tissue hypoxia. Diabetics are further more susceptible to infections because of decreased inflammatory response and inefficient bacterial killing. There will also be the impairment in the collagen synthesis in diabetes. All these factors leads to bursting of the abdomen. The most common cause of delay in wound healing is the presence of infection. Presence of bacteria prolongs the inflammatory phase and interferes with the epithelialisation, wound contraction and collagen deposition.[38]

Obesity is also the most common risk factor for abdominal wound dehiscence. The presence of excessive adipose tissue in the subcutaneous layers makes obliteration of the dead space more difficult and because of increased difficulties with hemostasis encompass the formation of hematoma and would infection.[38]

In a study carried out at Oula University Hospital, out of 48 patients who had wound dehiscence, mortality was reported to be 4% (2 patients). The

mean hospital stay was 25±15 days. 31 (65%) patients had pre-operative hypoalbuminemia; other risk factors included anemia, malnutrition, pulmonary complication and emergency procedure.[52]

In a study at Department of Surgery Sundsvaell County Hospital, Sweden being overweight (BMI > 25) was considered as a risk factor for delayed wound healing due to increased chance of infection but this could be minimized if patients are sutured with a suture length to wound length ratio of 4 - 4.9:1. In this study 36 patients were overweight, (BMI > 25), 24 patients were having their BMI below 25.[53]

In a study conducted in Department of Surgical Gastroenterology, University of Copenhagen, Hvidovre Hospital in 2001 reported that the incidence of abdominal wound dehiscence and burst abdomen is more common in patients with vertical incision in comparison to those with horizontal incision ($p = 0.0001$).[54]

CLINICAL FEATURES:

Patients with abdominal wound dehiscence presents with various sign and symptoms, most commonly encountered symptoms include:[55]

- Bleeding
- Pain
- Swelling
- Redness
- Fever
- Broken sutures
- Open wound

Wound dehiscence can occur without any warning. Incisions which are at increased risk of dehiscence may show signs of inflammation beyond the time and extent expected for normal healing, for e.g. more exaggerated incisional redness, swelling, warmth and pain that extend beyond post-operative day 5. Palpation of the surgical incision and surrounding area may reveal warmth and a collection of fluid under some part of incision or whole of the incision (a seroma, haematoma or abscess). A sudden

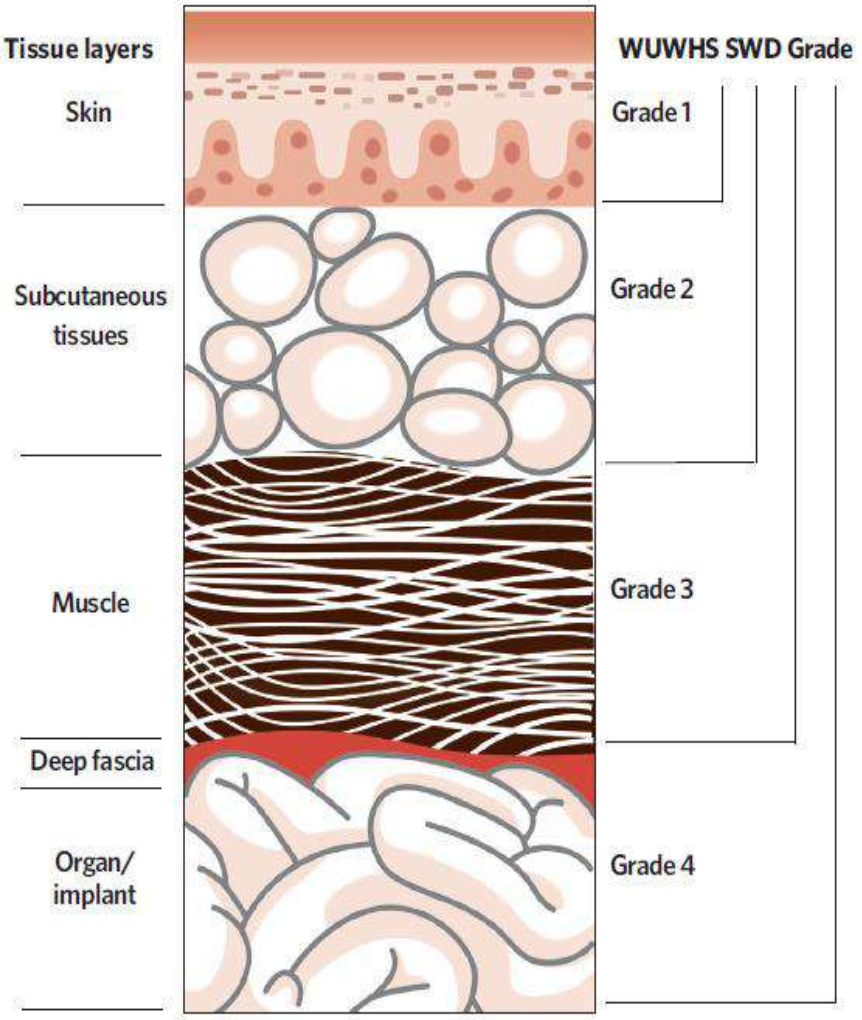
increase in pain or discharge of serosanguineous fluid from the incision may announces a surgical wound dehiscence.[56,57]

IDENTIFICATION/ GRADING OF WOUND DEHISENCE:

Systems for grading or classifying SWD often relate to specific types of surgery, e.g. thoracic or abdominal surgery. Some classifications are adaptations of the adverse event reporting systems, e.g. of the Ottawa Thoracic Morbidity and Mortality system or the Clavien-Dindo system. There is a need for a general classification system for SWD that is applicable to incisions from all surgery types, which is easy to use and is suitable for use in all care settings, that indicates severity, and that can be linked to appropriate management strategies. World Union of Wound Healing Societies proposed SANDY Grading system for gross appearance of wound dehiscence and associated clinical signs and symptoms:[58]

1	Dermal layer only involved; no visible subcutaneous fat
1a	As Grade 1 plus clinical signs and symptoms of infection (e.g. superficial incisional SSI)
2	Subcutaneous layer exposed; fascia not visible n No clinical signs and symptoms of infection
2a	As Grade 2 plus clinical signs and symptoms infection (e.g. superficial incisional SSI)
3	Subcutaneous layers and fascia exposed n No clinical signs and symptoms of infection
3a	As Grade 3 plus clinical signs and symptoms infection (e.g. deep incisional SSI)
4	Any area of fascial dehiscence with organ space, viscera, implant or bone exposed n No clinical signs and symptoms infection
4a	As Grade 4 plus clinical signs and symptoms infection (e.g. organ/space SSI)

DIAGRAMATIC REPRESENTATION OF SANDYS GRADING:



The diagnosis of infection of a surgical incision or a dehisced wound is largely based on local and systemic clinical signs and symptoms. Fever in the first 48 hours after surgery is unlikely to be due to surgical site infection or wound dehiscence. The role of sampling and microbiological culture in the diagnosis of SSI is controversial reasons for this being that superficial sampling, such as swabbing, may reflect only surface bacteria and not bacteria in deeper tissues an issue of particular relevance to deep surgical wounds. The various clinical signs and symptoms which points towards wound dehiscence are divided into local and systemic ones such as:[57,58]

Local signs and symptoms of SWD

1) Erythema – localised or spreading (cellulitis)
2) Pus/purulent or haemopurulent exudate
3) Abscess n Swelling/induration
4) Local warmth
5) Malodour
6) Crepitus
7) Dehiscence
8) Unexpected pain or tenderness

Systemic signs and symptoms of wound dehiscence

1) Malaise
2) Loss of appetite
3) Pyrexia or hypothermia
4) Tachycardia
5) Tachypnoea
6) Elevated C-reactive protein (CRP)
7) Elevated or suppressed white blood cell count
8) Sepsis
9) Septic shock

ROLE OF DRESSINGS IN WOUND DEHISCENCE:

In order to achieve proper healing of wound, dressings play crucial role in healing process by maintaining moist environment, protecting from injury and contamination, control bleeding and by decreasing chances of infection. There are two types of dressings one is primary dressings which are placed directly over the wound and other are secondary dressings which are used to hold the primary dressings in place. Dry dressings are still commonly used, which include various type of dressings such as protective dressings, antibacterial dressings, adsorbent dressings and debriding dressings.[59]

PROTECTIVE DRESSINGS:[59-61]

Dressings	Wound type	Use
Dry gauze	Draining wounds	Cotton or synthetic fibres absorb drainage Nonocclusive, inexpensive and easily available
Silicone	Wounds or incisions with abdominal healing	Gel sheets that relax and soften scar tissue It does not stick to the moist wound bed and adheres to the surrounding skin gently
Hydrogels	Pressure ulcers, partial or full thickness wounds, vascular ulcers, burns, abrasions and skin tears	Water/ glycerin based dressings that provide moisture to dry wounds Soften and loosen slough and necrotic wound tissue
Transparent films	Closed surgical incision sites, skin grafts, donor sites and catheter sites	These are thin transparent sheets with adhesive backing Protect from water and bacteria, provides a moist environment and debrides the wound
Impregnated gauze	Skin grafts, donor sites and skin tears	These are gauze treated with substances such as zinc, petroleum and iodine that adds moisture to wound and promotes wound healing by decreasing pain

ANTIBACTERIAL DRESSINGS:[59-61]

Gauze with added iodine or silver helps to keep the wound moist, prevent infection and provides nonsticky coverage.

Dressings	Wound type	Use
Antibacterial ointment	Dry wounds that are or have chances to get infected	They can promote healing by stopping the growth of certain bacterias which are capable of disrupting the the healing process
Iodosorb (cadexomer iodine)	Pressure ulcers, venous leg ulcers, diabetic foot ulcers and minor burns	Absorbs bacteria and fluid from the wound and also aids in debridement by removing dead tissue
Silver based dressings	Wounds that are likely to get infected such as burns and abrasions	Silver is an agent that is effective against bacteria, fungi, viruses and yeast and also active against MRSA and VRE

ADSORBENT DRESSINGS:[59-61]

These dressings help to collect moderate to heavy drainage from the wound and provides coverage and protection.

Dressings	Wound type	Use
Foam	Moderately to heavily drainage wound, diabetic ulcers, ostomy sites and full thickness wounds	Polyurethane pads, sheets or cavity packing that have airtight and water backing Maintains wound moisture
Collagen	Minimally to heavily draining wounds, minor burns , donor sites and slow healing ulcers	Woven material that absorbs blood and forms a gelatin mass, thus protecting the wound

Alginates	Vascular ulcers, surgical incisions, wound tunnels, exposed tendons and infected wounds	Non woven fibres made from seawood forms gel while placed on wound and provides moisture Can trap bacteria also
Hydrofibres	Moderate draining wounds and pressure ulcers	Sterile fibrous sheets convert to a solid gel and conform to the wound when moistened.

DEBRIDING DRESSINGS:[59-61]

There are many wounds that require a dressing that can debride dead, damaged and infected tissue to improve wound healing.

Dressings	Wound type	Use
Hydrogels	Pressure ulcers, vascular ulcers, burns, partial and full thickness wounds	Water or glycerin based dressings that provide moisture to dry wound, soften and loosen slogh and necrotic tissue
Hydrocolloid	Necrotic wounds, minor burns, pressure ulcers and moderate drainage wounds	Inner layer of these dressings is made up of colloid gel or paste that provide moist healing and thermal insulation

ASSESSMENT OF WOUND HEALING:

Wound assessment based on the type, cause and characteristics of the wound is necessary to help in deciding the type of treatment required to manage the wound effectively and to promote the healing. the characteristics of the wound which are important to be assessed include the anatomic location of wound, type of wound, extent of tissue

involvement, type and percentage of tissue in wound base, wound size, wound exudates and periwound area.[62]

The assessment of wound and the plotting of wound size with time is the only estimated way that can be used to predict the wound healing.This includes variables such as wound exudates, presence of necrotic tissue, slough and granulation tissue as well as undermining of edges.

Various methods for wound measurement includes:[62-66]

1) Wound evaluation score
2) Vizitrack
3) 3D video assessment
4) Direct visual wound measurement or visual analogue score (VAS):[62,67]
   - Greatest length and width method
   - Clock method
   - Combination method (Greatest length and width method & Clock method)
   - Photo documentation with ruler
   - Wound tracing

GREATEST LENGTH AND WIDTH METHOD:

This method includes measurement of diameter of wound across the greatest length and width. Length and width can be multiplied to yield the square area of the wound.

This single digit can be compared over time and should be decreased if the wound is healing.

CLOCK METHOD:

In this method face of the clock is used to guide measurement of the wound.

The twelve reference position is towards the head of the body and the measurements are obtained from12 to 6 and 9 to 3 clock o positions. Depth should be included in both of these methods to provide 3D measurement of wound. To measure depth gently insert a moistened

cotton swab into the deepest part of the wound. Grasp the swab at wound edge or margin and place it against a ruler for measurement.

COMBINATION METHOD:

In this method longest length and width perpendicular to the length are measured and multiplied together to obtain the surface area.

PHOTO DOCUMENTATION:

Photos can also be taken to document the wound healing. However this method cannot access accurately the wound size unless a ruler is used to measure the size. It also cannot assess wound depth accurately.

WOUND TRACING*:*

In this method a marker or pen is used to trace the outline of wound. It is relatively painless or a simple method to compare one measurement to the next.

In the present prospective study VAS/ perimetry by greatest length and width method is being applied for the assessment of wound. The various parameters assessed include:

- Site
- Size
- Depth
- Length
- Width
- Margins
- Base
- Slough +/-
- Granulation tissue +/-
- Periskin healthy/ dirty

HISTORY OF WOUND HEALING AND DEHISCENCE:

History of understanding the wound healing process dates back to 1650 BC when EGYPTIANS discover that closed wounds healed faster than open wounds. They created the first adhesive bandage by applying gum to the linen strips in drawing wounds together.

Ambriose Pare was the first person to condemn the use of boiling water and oil on war wounds to prevent suppuration and also suggested milder preparations for allowing them to heal. He was well aware of the nature's capacity to heal the wound and modestly accepted "**I clean the wound but he heals them".**

In 1600 dressings used in treatment included cotton linters, paper, feathers and dust. **(Alvarez, 1984).**[68]

John Hunter, "father of experimental surgery" extensively studied process of wound healing and further classified process of wound healing into healing by first intention and second intention.[69]

In 1990s use of non woven swabs, sleeve dressings, adhesive papers and planters or wipes began (**Alvarez, 1984).**[70]

Tomaseck[71] in 1982 concluded that collagen attracts fibroblasts in cell cultures and causes direct migration of cells at the site of wound disruption.

Hunt[72] in 1988 declared that collagen plays an essential role in providing new growth of new vessels/ neovascularisation.

In literature, as very less number of studies are done or highlighted to compare the efficacy of collagen and conventional dressings in abdominal wound dehiscence. The present study aims to compare the role of collagen and wound dressings in abdominal wound dehiscence and to rule out which one is more superior and cost effective.

Some studies conducted in literature to compare the efficacy of collagen dressings in promoting wound healing and role of several risk factors in hampering the healing process are as follow:

Veves A, Sheehan P, Pham HT[73] included a total of 276 patients in a study. The mean age of the patients was 58.3 years. Patients were randomized to receive Promogran (n = 138) or moistened gauze (control group; n = 138) and a secondary dressing. Dressings were changed when clinically required. After 12 weeks of treatment, 51 (37.0%) Promogran-treated patients had complete wound closure compared with 39 (28.3%)

control patientss, but this difference was not statistically significant (*P* = .12). The difference in healing between treatment groups achieved borderline significance in the subgroup of patients with wounds of less than 6 months duration. In patients with ulcers of less than 6 months duration, 43 (45%) of 95 Promogran-treated patients healed compared with 29 (33%) of 89 controls (*P* = .056). In the group with wounds of at least 6 months' duration, similar numbers of patients healed in the control (10/49 [20%]) and the Promogran (8/43 [19%]; *P* = .83) groups. Patients and investigators expressed a strong preference for Promogran compared with moistened gauze.

Donaghue VM, Chrzan JS, Rosenblum BI[74] in this study, wound size, when averaged over the 8-week period and with the duration of the ulcer taken into account, was reduced significantly in the collagen-alginate dressing group, as compared with the gauze dressing group (df = 1, p =.0049). It is concluded that the collagen-alginate test dressing is as or more effective and safe as the currently used treatment.

Singh O, Gupta SS, Soni M, Moses S, Shukla S, Mathur RK[75] in a study conducted in patients with chronic wounds at Department of Surgery, MGM Medical College and MY Hospital, Indore, India, with two weeks of treatment, 60% of the 'collagen group' wounds and only 42% of the 'conventional group' wounds were sterile (P=0.03). Healthy granulation tissue appeared earlier over collagen-dressed wounds than over conventionally treated wounds (P=0.03). After eight weeks, 52 (87%) of 'collagen group' wounds and 48 (80%) of 'conventional group' wounds were >75% healed (P=0.21). Eight patients in the 'collagen group' and 12 in the 'conventional group' needed partial split-skin grafting (P=0.04). Collagen-treated patients enjoyed early and more subjective mobility.

Rao H, Pai A, Hussein I, Pai SR, Pai S[76] conducted a comparative study between Collagen Dressings and Conventional Dressings in Manipal university, concluding that collagen dressing is safe and effective in the treatment of foot ulcer and significantly reduces healing time, duration of antibiotic therapy and follow up time.

Kolenik SA, McGovern TW, Leffell DJ[77] in a study showed that an average time to complete granulation with bovine collagen was 3.5 weeks, while the time for complete re-epetheliasization was 6.1 weeks. The control sites were evaluated only for time to complete reepitheliazation (complete healing), and this averaged 9.4 weeks for all 15 wounds. While the collage-matrix –treated wounds healed over 3 weeks faster and in 65% of the time it took the conventionally – treated wounds to heal.

Krishna N MM, Kumar KS, Prasad GL[2] conducted a study on total of 120 subjects from a cohort to identify risk factors in patients developing abdominal wound dehiscence and to calculate the incidence of abdominal wound dehiscence. Of total 120 subjects, 30 subjects developed wound dehiscence and were considered as cases. And remaining subjects who did not develop the dehiscence but has the risk factors for its development were considered as controls. There were 12 males and 18 females in Cases. 36 males and 54 females were there in Controls. In this study, many risk factors were observed to be the cause for the development of abdominal wound dehiscence. Many of the patient related risk factors were proved to be the cause for the development of dehiscence. Hypoproteinemia, Anaemia, Renal failure, uremia, presence of malignancy, associated diseases like Diabetes, hypertension, COPD and immunocomprimised state of the patient, factors which increase intra abdominal pressure like post operative cough, vomiting, abdominal distension and urine retention, development of the wound infection plays a role in the development of wound dehiscence.

Lakshmi G, Ravimohan TR[78] in a prospective study included thirty three patients who developed wound dehiscence following various types of laparotomies in Osmania general hospital from July 2008 to October 2010. The patients were selected randomly. All the patients with burst abdomen during were included, and those who were lost with follow up and who died were excluded from the study. The results showed the incidence is common during the 3rd to 6th decade. 78.7% of the patients were males and maximum incidences (72.72%) of wound dehiscence were encountered with emergency laparotomies. Peritonitis (51.51%) and duration of surgery more than 2.5 hours are (48.48%) the major risk factors. Bursts were seen mostly during 6th to 10th post operative day. Anemia in 63.63%, hypoprotenemia in 63.63%, post operative wound infection in72.72%, and respiratory infections in 51.51% were the contributing factors. Post laparotomy wound dehiscence has multifactor etiology.

Soni P, Haripriya VB, Dutt V[79] conducted a study to assess the patients, who had undergone laparotomy and developed burst abdomen. The study included 162 patients who underwent laparotomy to know the occurrence of burst abdomen. The age of the study subjects was from 31 to 64 years. Pre-operative predisposing factors related to burst abdomen were also recorded. The clinical diagnosis of the patients was done such as physical examination, hematological investigations. Out of 162 patients treated, 16 developed burst abdomen with a percentage of 9.87%. Patients treated with emergency laparotomies was higher in number that is 15/102 (14.7%) while only one patient with elective laparotomy (1/60, i.e., 1.7%). The frequency of burst abdomen was significantly higher in older age group as compared to younger. The most common risk factors were malnutrition (20.3%), followed by obesity (12.5%), anemia (12.4%), wound infection (11.9%), coughing (9.6%), and distension (8.5%).

Mary CF, Chudar A, Karthikeyan R[80] performed a study to study the clinical profile of patients with the diagnosis of abdominal wound dehiscence, the incidence of wound dehiscence in emergency abdominal surgeries, the type of surgery, duration and type of anaesthesia leading to wound dehiscence, significant risk factors in patients developing abdominal wound dehiscence and the management of wound dehiscence. A total of sixty patients were taken which included both male and female of adult age group diagnosed with dehiscence of abdominal wound after undergoing surgical intervention. Maximum cases were found to be in the 46-60 years age group. There was a marked male predominance in the sex distribution. Patients included in the study had been operated on for diverse surgical conditions, most common among the study population being perforated duodenal ulcer. Next common conditions were ileal perforation. 77.5% cases of abdominal wound dehiscence were found to occur following emergency surgery and 22.5% following elective surgery. Most cases studied had comorbidities or systemic illnesses such as diabetes, hypertension and anemia. Most cases were found to present with burst abdomen on the 7th and 8th postoperative days. Majority of the cases were managed with secondary suturing.

Kapoor KK, Hassan Mir MN[81] conducted a study, aimed at finding out the prevalence of abdominal wound dehiscence with different risk factors and also to study the effective management of abdominal wound dehiscence. All cases presenting with wound dehiscence after surgery were included. An elaborate clinical history was taken in view of the significant risk factors, the types of surgery performed including surgical incisions taken and the type of disease involved. Total of 60 cases were included in this prospective study. The results concluded that male patients have a higher incidence of laparotomy wound dehiscence that too in 5th decade. Patients presenting with peritonitis secondary to hollow viscus perforation are more prone to abdominal wound dehiscence.

Patients classified with contaminated wounds with emergency surgeries show higher predilection for wound dehiscence.

Walming S, Angenete E, Block M, Bock D, Gessler B, Haglind E[82] in a study demonstrated that several factors and patient characteristics influence the risk of surgical wound dehiscence and incisional hernia after midline laparotomy. The purpose of this study was to investigate whether a specified, or not specified, suture in the operative report affects the incidence of surgical wound complications and to describe the previously known risk factors for these complications. A total of 1,621 patients were included in the study. On analysis wound infection was a risk factor for both wound dehiscence and incisional hernia. BMI 25–30, 30–35 and >35 were risk factors for wound dehiscence and BMI 30–35 was a risk factor for incisional hernia. These results support previous findings identifying wound infection and high BMI as risk factors for both wound dehiscence and incisional hernia. This study indicates the importance of preventive measures against wound infection and a preoperative dietary regiment could be considered as a routine worth testing for patients.

Another study by **AFZAL S, BASHIR MM**[83] aimed to find an association and prevalence of risk factors and wound dehiscence. Patients who underwent exploratory laparotomy through vertical abdominal incisions with one or more risk factors were included in the study. The main out come measures found significant were wound infection- sepsis, hypoprotinemia, diabetes mellitus, emergency surgery, steroid use and advancing age. A total of 430 patients under went laparotomy through vertical incisions during last one and half years. Complete record of all the patients was maintained on Proforma. Trained surgeons with latest recommended protocol closed their wounds by using monofilament nonabsorbable 1 gauge suture taking 1 cm bite from the edge with 1 cm interstitch interval. All risk factors were made measurable on bases of history, examination, and investigations. Patients were closely observed

post operatively on day 3, 7, and 10, special attention being paid to development of wound infection or wound dehiscence. Out of 430 patients, 35 patients had acute wound failure. 32 patients had the catastrophe happening in emergency laparotomies where as only 3 cases were noted in elective laparotomies (P< 0.001). The main out come measures found significant were wound infection- sepsis, hypoprotinemia, diabetes mellitus, emergency surgery, steroid use and advancing age.

MATERIALS AND METHODS

In this present prospective study 50 cases with abdominal wound dehiscence in department of surgery, Dayanand Medical College and Hospital, Ludhiana during period from December 2017 to may 2019 were studied.

A total of 50 patients suffering from abdominal wound dehiscence were selected for the study. After explaining the procedure and motto of the study, written informed consent was taken prior to the enrolement of the study. All patients admitted with post operative abdominal wound dehiscence were interviewed as per the proforma and a complete clinical examination was done.

Cases were allocated randomly into test group and control group, test group treated with collagen dressing and control group treated with standard dressing. Cases were assessed for healing time, pain using VAS score, healing quality by assessing wound perimetry, number of dressings and complications in both the groups.

INCLUSION CRITERIA

- Age group between 15years to 60 years Abdominal Wound - Post operative wounds.
- Patients who have developed abdominal wound dehiscence.
- Patients who are willing for investigations and treatment.
- All patients who have developed wound dehiscence after any abdominal incision.
- Patients with wound dehiscence having systemic diseases like diabetes mellitus, COPD, and anaemia.
- Patients who developed wound dehiscence due to comorbid obesity.

EXCLUSION CRITERIA

- Hypersensitivity to Collagen
- Age group more than 60 years
- Age group less than 15 years

- All patients with incisional Hernia.
- All Patients who have developed evisceration.
- All patients with wound dehiscence on sites other than the abdomen.
- All patients who refuse investigations.
- All patients who refuse admission and further treatment.

PATIENT EXAMINATION

Each selected patient underwent detailed history and complete physical examination. History regarding age, sex, diabetes, hypertension and duration of wound dehiscence, size of wound (length, breadth) and margins of wound along with appearance of wound were recorded. Blood pressure was recorded in lying down, sitting and standing positions at interval of 5 minutes and compared in both arms. Systemic hypertension was defined as systolic BP= 140 mmHG or patients and diastolic BP= 90 mm of HG.

We also assessed the abdominal wound dehiscence by detailed clinical history and examination (perimetry) as given in the protocol:

- Site
- Size
- Depth
- Length
- Margins/edges
- Periskin changes
- Slough +/-
- Granulation +/-
- Discharge +/

Appropriate investigations were undertaken which included hemogram (Hb, TLC, Platelets), blood sugar levels, renal function test, and serum albumin levels. Xray chest was also done in every case to rule out underlying co-morbid chest conditions leading to wound dehiscense. The abdominal wound dehiscence's greatest length, width and depth were measured. The wound was assessed before and after dressings, wound

bed characteristics and peri wound skin were assessed. The wound area was analysed by means of perimetry (greatest lengthx width in mms).

Eligible patients were divided into study and control groups. The procedure of perimetry was performed in study as well as control group. In study group collagen dressings were done where as in control group standard dressings were performed. In collagen dressings the wound was initially irrigated with normal saline and periskin was cleaned with betadine using dry gauge piece followed by application of collagen granules over the wound base. It was covered with gauze and bandage and no other chemical was used. Where as in control group only standard dressings such as simple betadine dressing, paraffin gauze dressings was done. The frequency of dressing change was once a day and if soakage was high then dressing was done twice a day.

MANAGEMENT:

Anemia, hypoalbuminemia, diabetes, hypertension and respiratory comorbidites were treated accordingly.

The protocol followed in the management comprised of:

- Local management of the wound
- Management of associated co-morbidities
- Control of sepsis

Local management of wound:

As already discussed earlier the wound dehiscence in control group was managed with standard dressing and the study group was treated with collagen dressings followed by assessment of healing using perimetry**.**

Management of associated co-morbidities:

Anemia which is one of the risk factor which can disrupt wound healing by low tissue perfusion was managed by appropriate blood transfusions in order to enhance accurate wound healing.

Hypoalbuminemia was managed by supplementing adequate amount of proteins by intravenous route (Inj HUMAN ALBUMIN 25% W/V) and in the

patients which were orally allowed, high protein oral supplements were given.

In obese patients abdominal binders were used to prevent further wound dehiscence.

Hypertension and diabetes were managed by appropriate antihypertensives and antidiabetic measures.

Patients with respiratory issues such as cough, pleural effusion, bronchiectasis etc. were also aggressively managed to prevent raised intra abdominal pressure leading to wound disruption**.**

Control of sepsis:

Sepsis was controlled by using combination of systemic antibiotics and local treatments.

Treatment duration:

The treatment was given for 28 consecutive days from the day of wound dehiscence.

Evaluation of response:

As per the wound perimetry the dimensions of the wound were recorded on day 1 and weekly there after till 28 days and wound bed characteristics along with margins were also noted. The appearance of healthy granulation tissue was considered as end of the study.

At the end of the study period of 28 days, patients were categorized as:

1) **Non complete responders**: less than 50% reduction in wound size and area covered by granulation tissue.
2) **Partial responders:** 50% or > 50% reduction in wound size and area covered by granulation tissue.
3) **Complete responders**: complete healing of wound, and entire area covered with granulation tissue.
4) **Non responders**: no reduction in wound size and absence of any granulation tissue.

FOLLOW UP EVALUATION:

Follow up examination was completed on weekly bases, the following were asked and recorded:

1) Condition of dressing and wound
2) Compliance with dressing used and changed
3) Change in medication
4) Presence of any adverse effects
5) Number of dressings changed since previous evaluation

FINAL EVALUATION:

At last on day 28^{th} for completion of study the comparative analysis was done between collagen dressings and standard dressings.

STATISTICAL ANALYSIS

Two groups were compared, analysis of variance was calculated for the abdominal wound dehiscent size in mms using chisquare and p value. In other variables such as age, BP, Hb, and related investigations, ‘t’ test and p value were calculated.

OBSERVATIONS AND RESULTS

The present prospective study was conducted on 50 patients including control and study groups who underwent collagen and standard dressings for abdominal wound dehiscence post surgery. Assessment of wound healing post collagen and standard dressings was done. The observations and the results are presented under the following headings:

1) Clinical profile:
   a) Age
   b) Sex
2) Other common variables
3) Response to dressings on day 1st
4) Response to treatment on day 7th
5) Response to treatment on day 14th
6) Response to treatment on day 28th
7) Distribution according to type of surgical incision
8) Distribution according to type of surgery

CLINICAL PROFILE:

Table 1: Age Distribution

Age(years)	Study group (n=25)	Control Group (n=25)
18-30	8	5
31-50	6	10
51-60	11	10
Mean ± SD	42.96±14.19	46.12±14.15
t value	-1.028	
p value	0.309	

The age of the patients in both study group and control group ranged from 18 years to 60 years. With the mean age of 42.96 ± 14.19 in control group,

where as with mean age of 46.12 ± 14.15 in study group depicted in Figure 1). Most of the patients were in 4th and 5th decade of life in both study group and control group as shown in Figure 2.

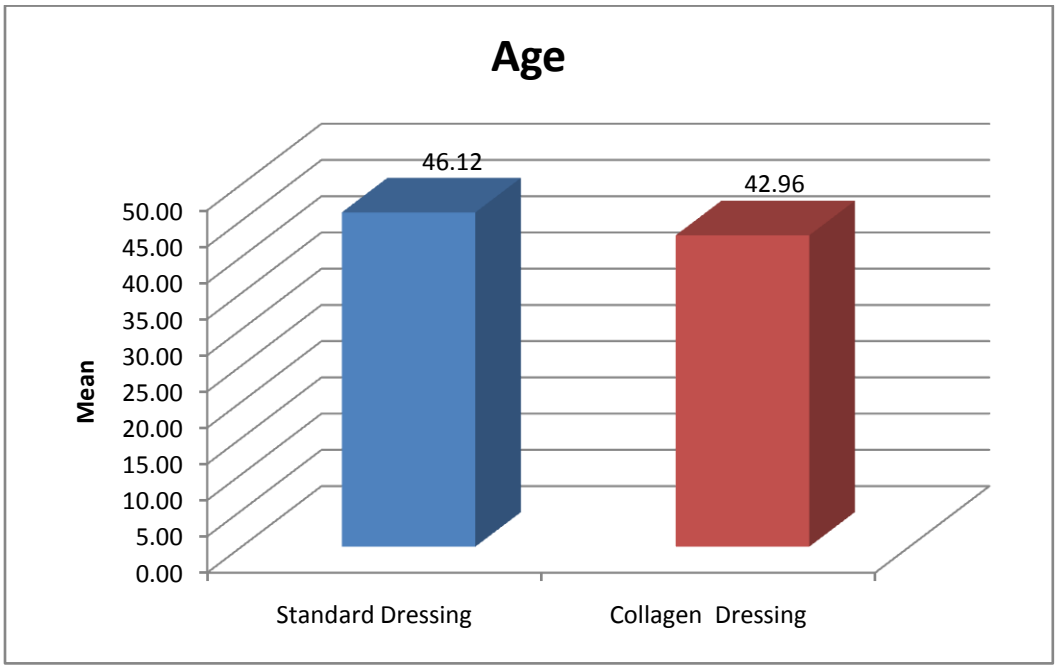


Fig 1: Mean age of patients (in years)

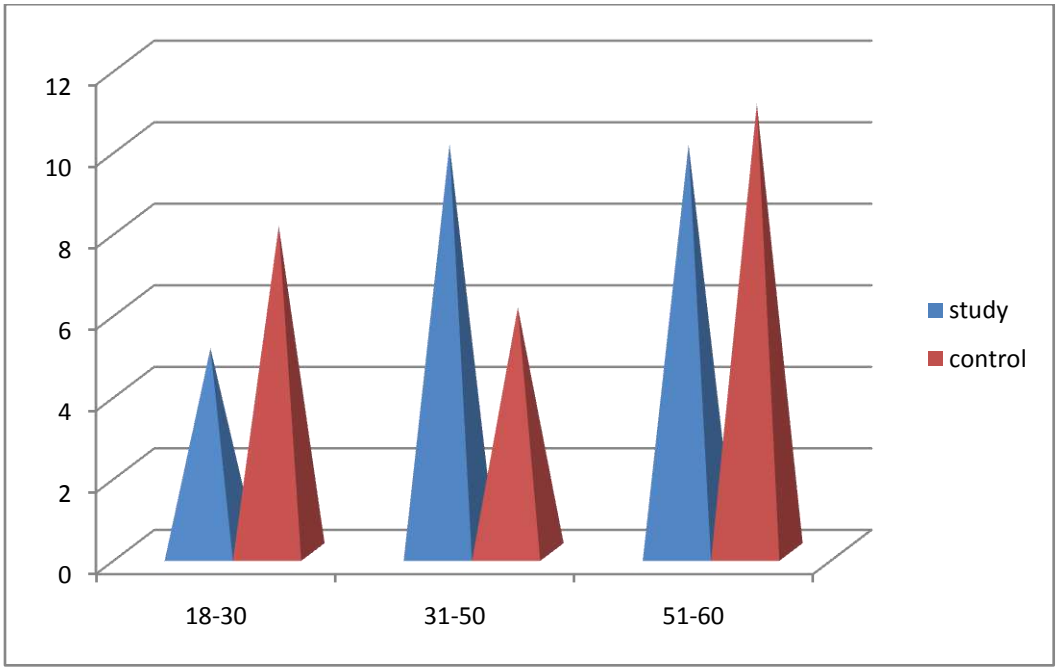


Fig 2: Age distribution of patients (in years)

Table 2: Sex Distribution

Sex	Study	Control
Female	6	9
Male	19	16
Total	25	25
p-value	0.355	
Significance	NS	

Table 2 shows sex distribution in both the groups. In study group out of total 25 patients 6 (24%) were females and 19 (76%) were male. Out of total 25 patients in control group 9 (36%) were females and 16 (64%) were male as shown in Fig 3. The sex distribution difference in both study and control group was statistically insignificant.

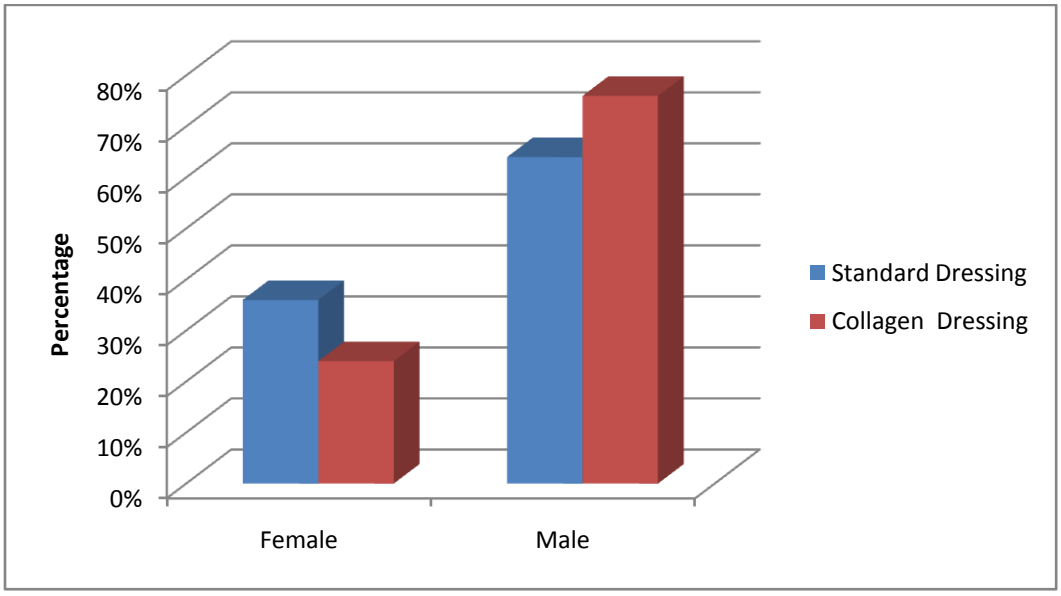


Fig 3: Sex distribution in study and control group

Table 3: Comparison of other variables

Variable	Study	Control	p- value	Significance
Age	42.96±14.19	46.12±14.15	0.309	NS
Sex (Male Female)	19(25) 6(25)	16(25) 9(25)	0.355	NS
Systolic BP	121.6±14.35	121.44±16.48	0.971	NS
Diastolic BP	76.60±8.52	75.68±9.39	0.44	NS
Size on day 28	621.76±679.23	624.64±1034.82	1.000	NS
HB	9.04±1.09	9.77±1.32	0.039	S
TLC	12916.0±2254.2	14844.0±3939.76	0.039	S
Urea	25.32±8.15	26.20±7.44	0.69	NS
Creatinine	0.97±0.34	1.11±0.43	0.210	NS
S. Albumin	3.30±0.27	2.97±0.49	0.006	S

Baseline characteristics of study group as well control group were comparable in all the variables. Most of the variables were non significant in both study group and control group. However HB, TLC, S. Albumin were highly significant (Fig 4, 5, 6) indicating that patients with these variables within normal range responded very well to the collagen dressings and standard dressings in comparison to the patients with de-arranged values.

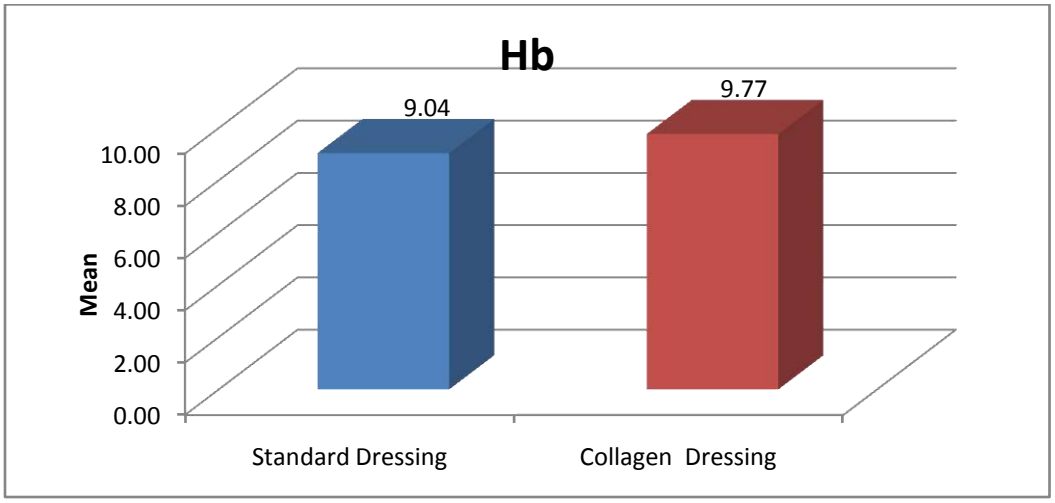


Fig 4: Mean Hb (g/dl)

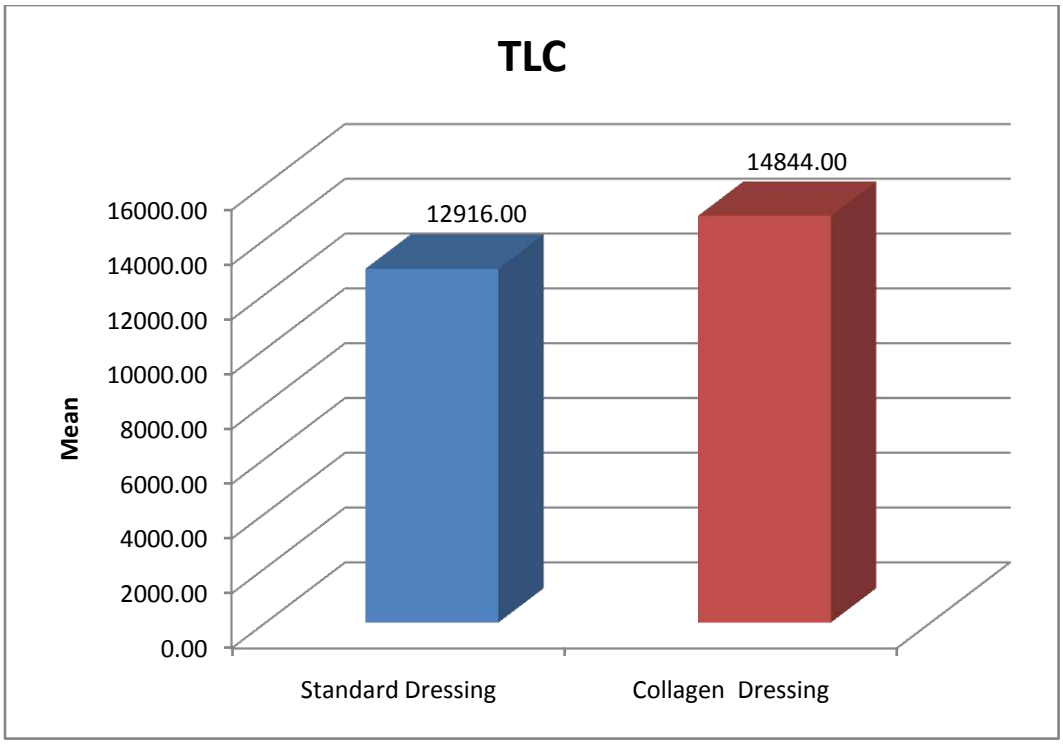


Fig 5: Mean TLC

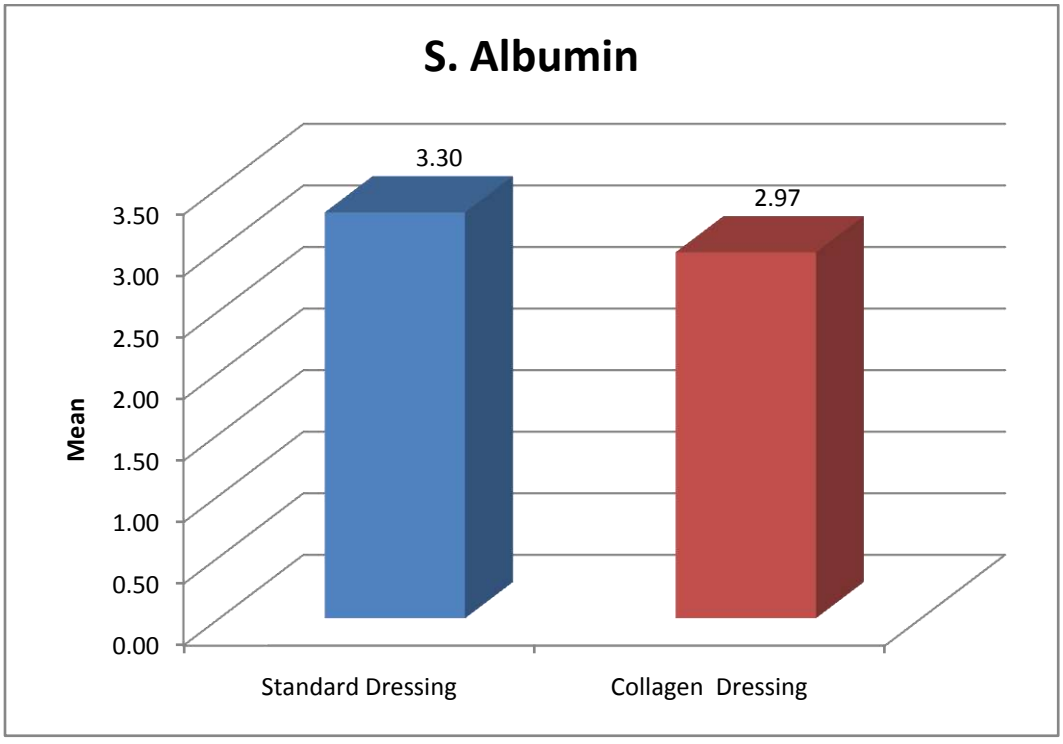


Fig 6: Mean S. Albumin (g/dl)

Table 4: Time of dehiscence

		Group				Total	Chi-square value	p-value
	Post op day	Standard Dressing	Standard Dressing	Collagen Dressing	Collagen Dressing			
Time of dehiscence	3rd day	1	4%	2	8%	3	2.028	0.845
	4th day	9	36%	7	28%	16		
	5th day	9	36%	9	36%	18		
	6th day	5	20%	4	16%	9		
	7th day	1	4%	2	8%	3		
	8th day	0	0%	1	4%	1		
Total		25	100%	25	100%	50		

Table 3 out of total 25 patients in study, maximum number of patients (n=18) developed wound dehiscence on post op day 4th and 5th. Similarly in control group most of the patients (n=16) developed wound dehiscence on post of day 4th and 5th. There was no significant statistical difference among both the groups (p value=0.845) (Fig 7).

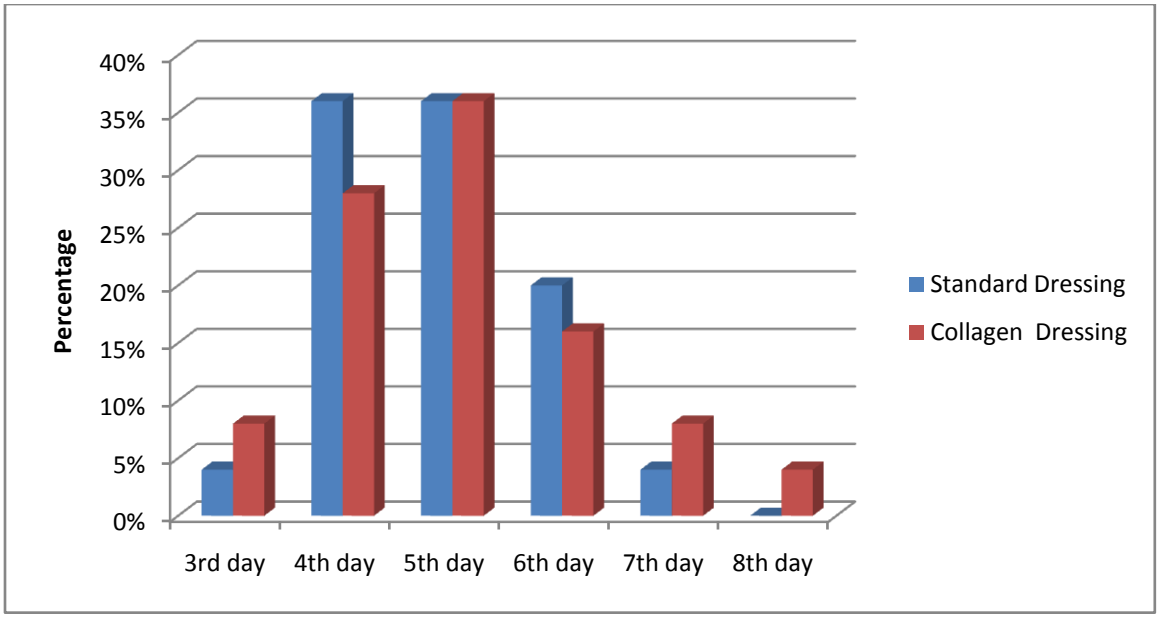


Fig 7: Time of dehiscence

Table 5: Comparison of wound size in both groups on day 1

	Standard Dressing		Collagen Dressing		t	p-value
Size on day 1	Mean	SD	Mean	SD		
	1848.00	1781.46	1258.64	1335.34	1.324	0.192

On day 1 the mean size of abdominal wound dehiscence in control group was 1848.0 mm^2 with standard deviation of ±1781.46 whereas in study group the mean size of wound dehiscence on day 1 was 1258.64 mm^2 with standard deviation of ±1335.34. The mean size was comparable in both the groups and was statistically insignificant (p value=0.192) Fig 8a. Representative examples of collagen and standard dressing are illustrated in the Picture 1 & 2.

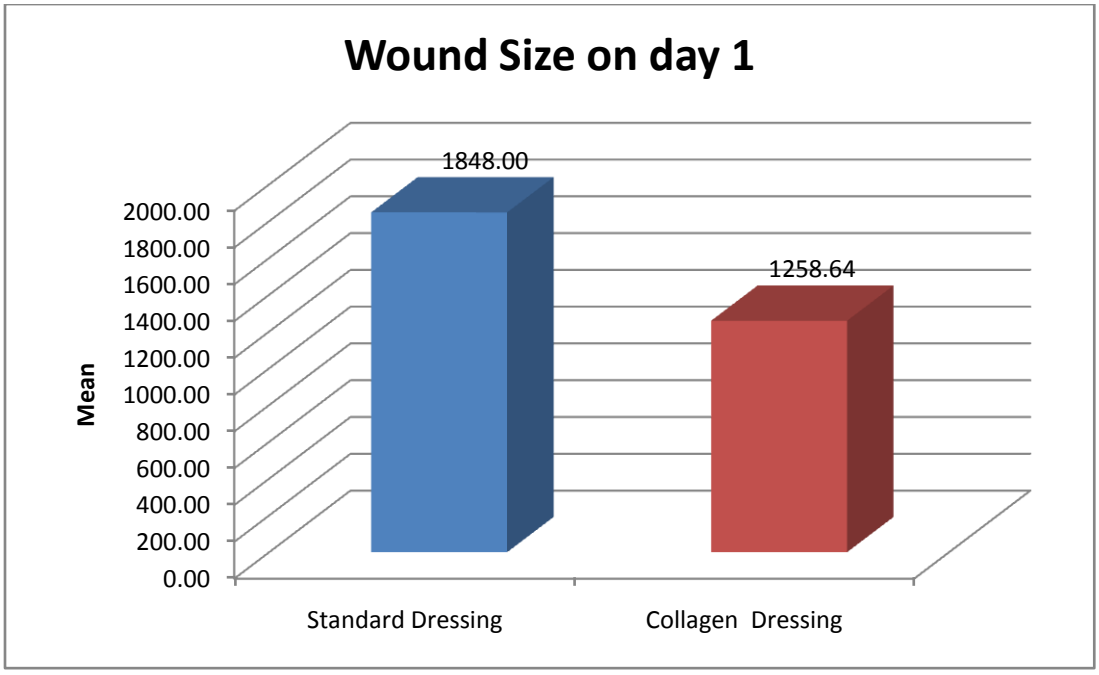


Fig 8a: Comparison of wound size in both groups (mm^2)

Table 6: Comparison of wound size in both groups on day 28

Size on day 28	Standard Dressing		Collagen Dressing		t	p-value
	Mean	SD	Mean	SD		
	621.64	1034.82	621.76	679.23	0.000	1.000

In control group on day 28th the wound size was 621.64 mm^2 with standard deviation of 1034.80, where as in study group the wound size was 621.76 mm^2 with standard deviation of 679.3. The size was comparable in both groups and was found to be statistically insignificant (p value=1.000) Fig 8b. Representative examples of collagen and standard dressings for day 28 are illustrated in Picture 3 & 4.

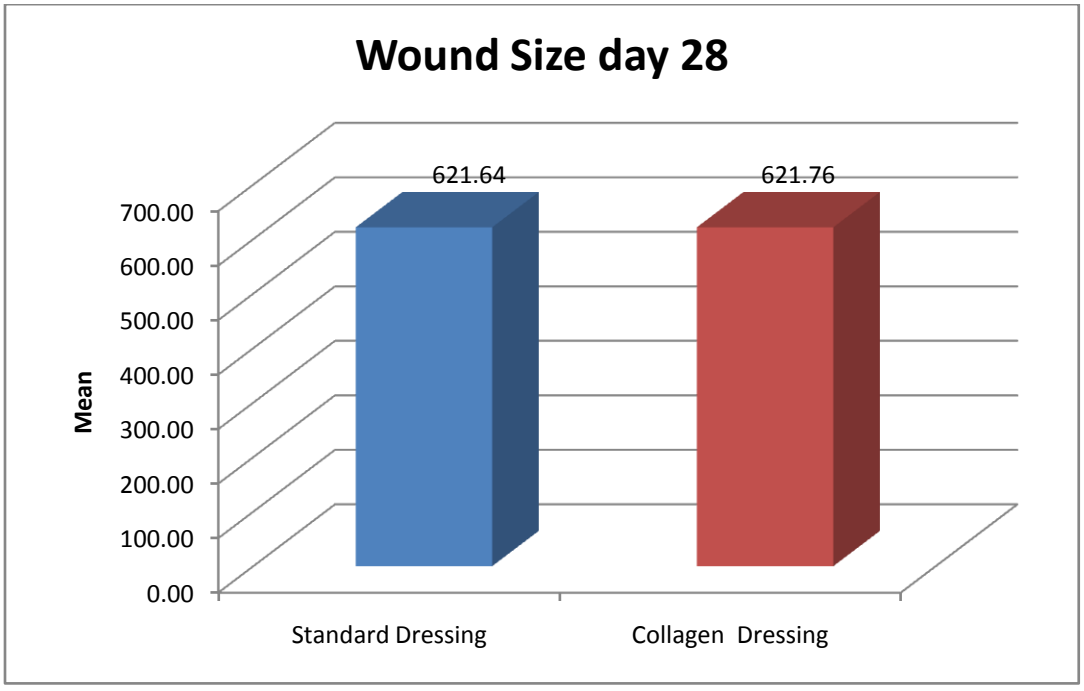


Fig 8b: Comparison of wound size in both groups (mm^2)

Table 7: Distribution according to healing response on day 1st

DAY 1	Response category	GROUP				Total patients
		Standard Dressing	Standard Dressing	Collagen Dressing	Collagen Dressing	
	NR	25	100%	25	100%	50
Total		25	100%	25	100%	50

On day 1st after treatment all the patients (n=25) in study group and (n=25) in control group were non responders (100%) in both the groups Fig 9. None of the patient (n=0) was in partial responder and non complete responder category.

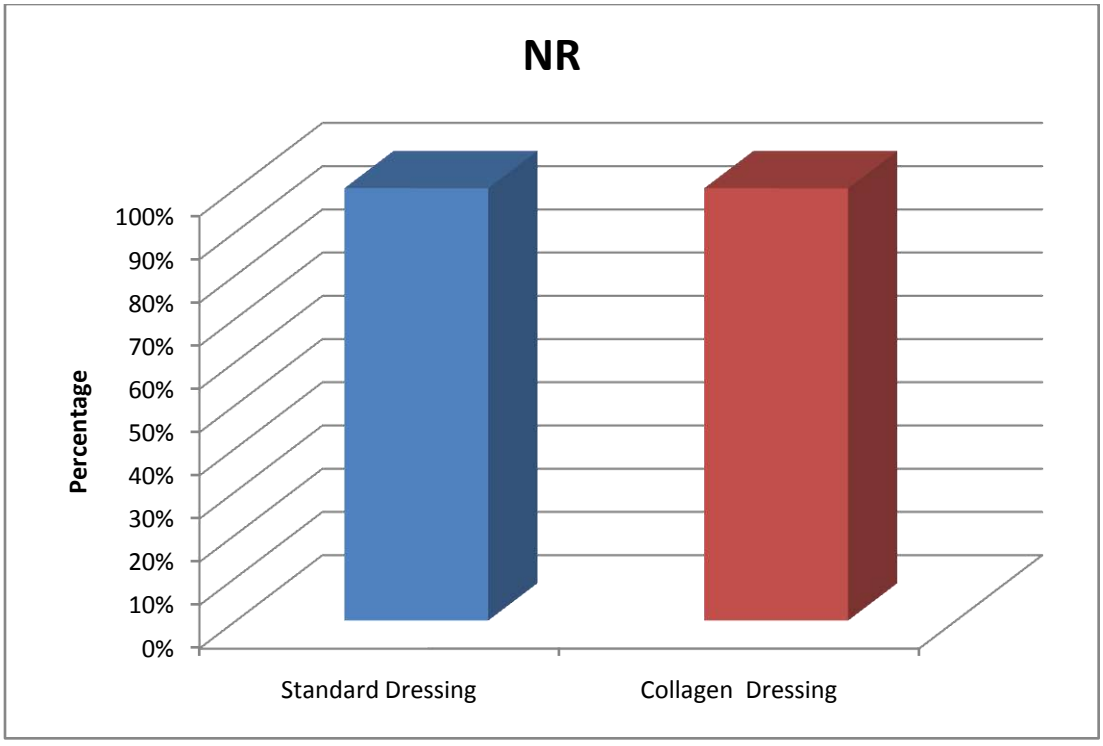


Fig 9: % of patients in Non Responder category

Table 8: Distribution according to healing response on day 7th

DAY 7	Response category	Group				Total	Chi-square value	p-value
		Standard Dressing (n=25)	Percentage	Collagen Dressing (n=25)	Percentage			
	NR	0	0%	0	0%	0	6.667	0.036
	NCR	20	80%	12	48%	32		
	PR	5	20%	10	40%	15		
	CR	0	0%	3	12%	3		
Total		25	100%	25	100%	50		

After 1st week on day 7th after treatment with standard and collagen dressings out of total 25 patients in control group 20 were non complete responders and 5 were partial responders, how ever there was no non responder and complete responders in study group on day 7th of treatment. While in study group out of 25 patients 12 (48%) were non complete responder, 10 (40%) were partial responders and 3 (12%) were complete responders and none was non responder Fig 10.

Response of healing to collagen dressings was highly significant in comparison to control group at the end of 7th day post treatment (p value=0.036).

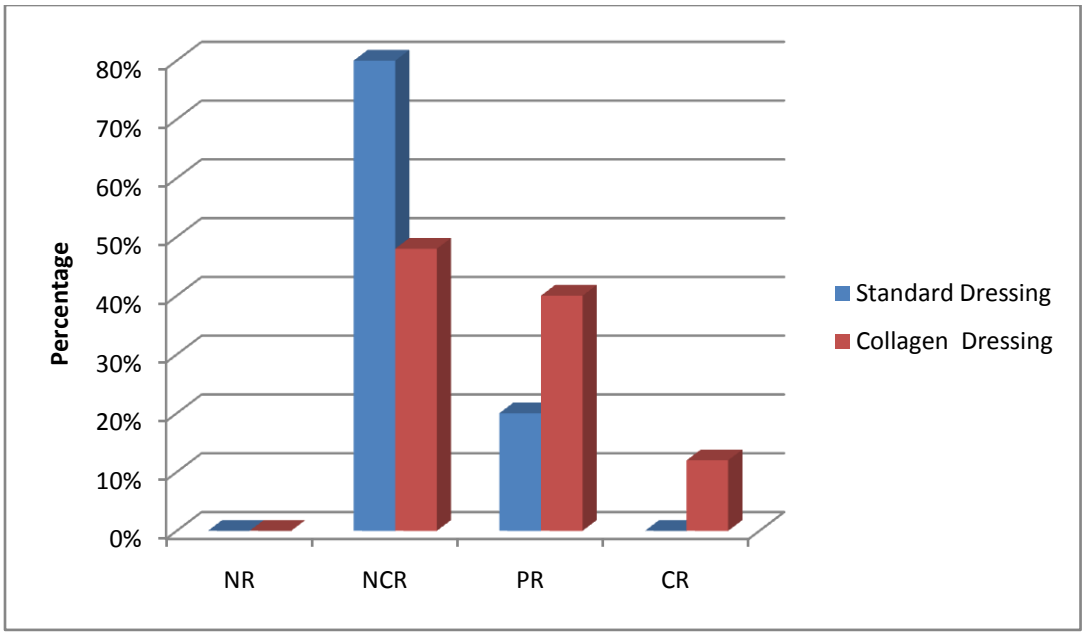


Fig 10: Distribution according to healing response on day 7th

Table 9: Distribution according to healing response on day 14

DAY 14	Response category	Group				Total	Chi-square value	p-value
		Standard Dressing (n=25)	Percentage	Collagen Dressing (n=25)	Percentage			
	NR	0	0%	0	0%	0	20.043	<0.001
	NCR	15	60%	1	4%	16		
	PR	10	40%	19	76%	29		
	CR	0	0%	5	20%	5		
Total		25	100%	25	100%	50		

On day 14 post treatment with standard and collagen dressings, out of 25 patients in control group 15 (60%) were noncomplete responders, 10 (40) were partial responders and none of the patients were in non responder and complete responder category. In study group out of 25 patients 1 (4%) was noncomplete responder, 19 (76%) were partial responders and 5 (5%) were complete responders and none of the patients were non responder Fig 11.

Complete respond to collagen dressings was statistically significant ($p < 0.001$) in study group at end of 14^{th} day.

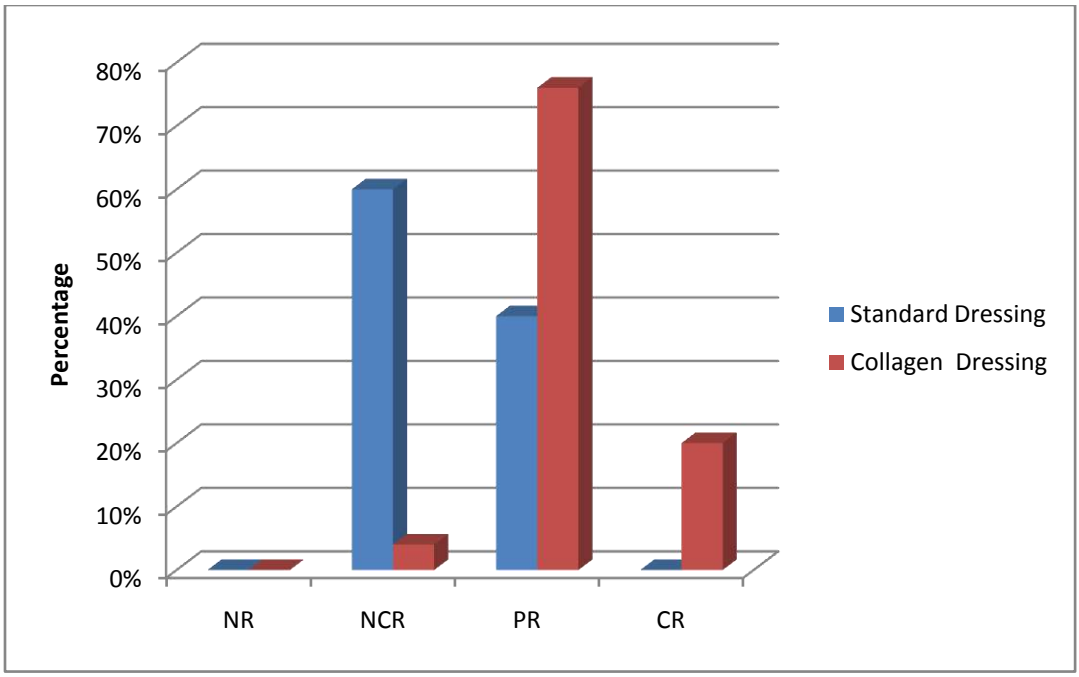


Fig 11: Distribution according to healing response on day 14

Table 10: Distribution according to healing response on day 28

Day 28	Response Category	Group				Total	Chi-square value	p-value
		Standard Dressing (n=25)	Percentage	Collagen Dressing (n=25)	Percentage			
	NR	0	0%	0	0%	0	18.545	<0.001
	NCR	2	8%	0	0%	2		
	PR	18	72%	5	20%	23		
	CR	5	20%	20	80%	25		
Total		25	100%	25	100%	50		

After 28 days out of total 25 patients in control group 2 (8%) were non complete responders, 18 (72%) were partial responders and 5 (20%) were complete responders. While in study group out of 25 patients 5 (20%) were partial responders and 20 (80%) were complete responders. In both groups there were no non responders. However in study group there was no noncomplete responder in comparison to control group in which there were 2 non complete responders Fig 12.

Complete respond at the end of 28 days to collagen dressings was statistically significant (p value<0.001) in study group.

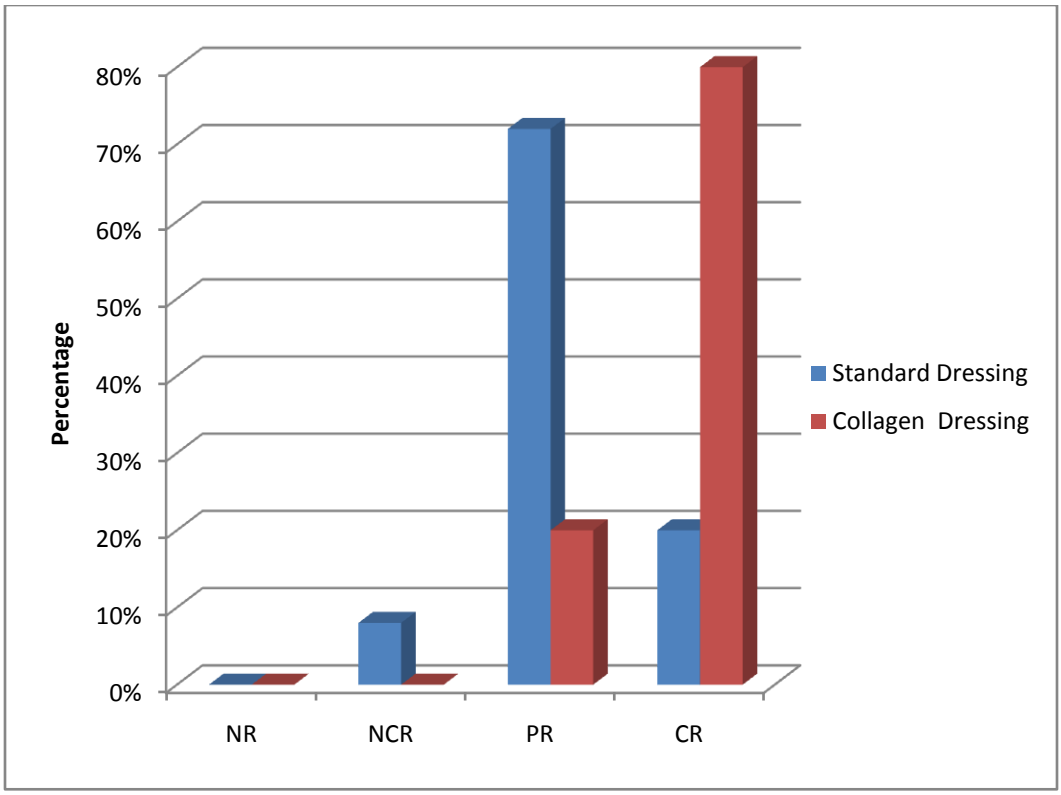


Fig 12: Distribution according to healing response on day 28

Table 11: Distribution according to type of incision

		Group				Total	Chi-square value	p-value
		Standard Dressing		Collagen Dressing				
Type of incision	T	5	20%	4	16%	9	0.136	0.713
	V	20	80%	21	84%	41		
Total		25	100%	25	100%	50		

Out of total 25 cases of control group, transverse incision was given in 5 patients and vertical incision was given in 20 patients. Whereas in study group out of 25 cases, transverse incision was given in 4 patients and vertical incision was given in remaining 21 patients. However no significant correlation was noted between the type of incision resulting in wound dehiscence.

Table 12: Distribution according to type of surgery: Elective v/s Emergency operation

Type of surgery	No. of cases	Percentage	Chi-square	p-value
EL	21	42	2.053	0.152
EM	29	58		
Total	50	100		

Out of total 50 cases (study and control group), 21 patients underwent elective surgery and 29 underwent emergency procedure as shown in Fig 13. There was no statistical correlation found between these two variables (p-value=0.152).

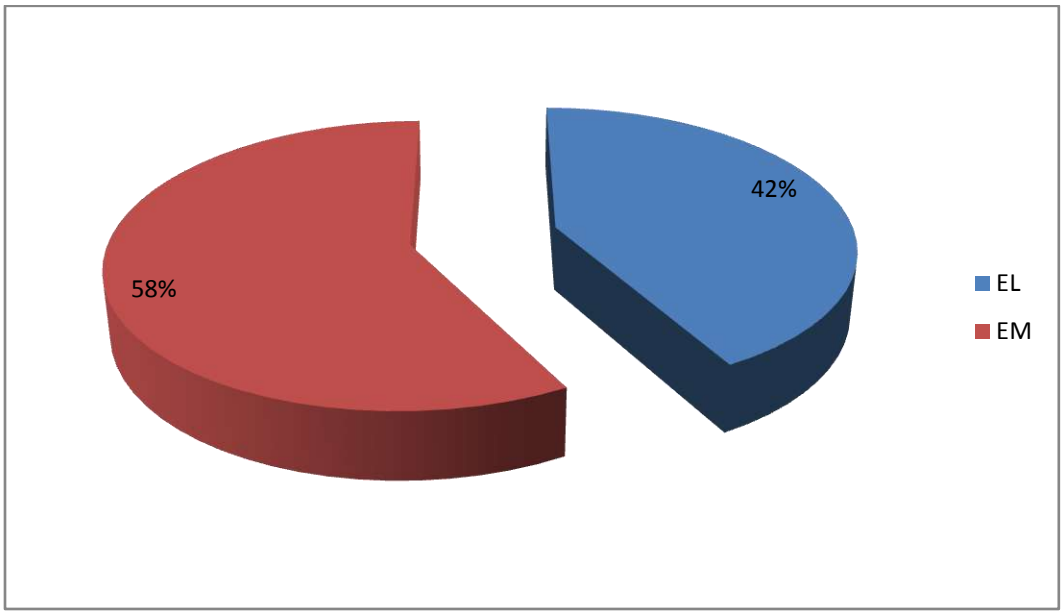


Fig 13: Distribution according to type of surgery

DISCUSSION

Abdominal wound dehiscence, also known by the name of (burst abdomen, fascial dehiscence) is a severe and fatal postoperative complication, with mortality rates reported as high as 45%. The incidence of abdominal wound dehiscence, as described in the literature, ranges from 0.4% to 3.5%.[81] Abdominal wound dehiscence can result in evisceration, that requires immediate treatment. Prolonged hospital stay, surgical site infection, high incidence of incisional hernia, and subsequent reoperations are some of the complications of postoperative abdominal wound dehiscence.[82]

Despite advances in perioperative care and suture materials, incidence and mortality rates in regard to abdominal wound dehiscence have not significantly changed over the past many decades. All this may be attributable to increasing incidences of risk factors within patient populations outweighing the benefits of technical achievements. Two general factors that play role in causing wound dehiscence – includes metabolic and local anatomic abnormalities and technical factors. Many aspects of the technical factors are within the surgeon's control, such as the site of the abdominal incision, technique of closure and type of suture employed, the use of retention sutures, and the placement of drains in relation to the wound.[13,32] Metabolic abnormalities are usually corrected before elective operations, a factor which increases the risks in emergency operations. At the same time, the unalterable variables of patient age, the procedure itself - whether it be elective, emergent, clean, or contaminated, and associated systemic illness have been shown to be contributory in impairment of wound healing process. Although specific guidelines describe the re-operative management of abdominal wound dehiscence.[31]

However in the end an effective management is required to treat abdominal wound dehiscence in order to prevent high morbidity and mortality rate. Different modalities of treatment have been used till date to treat the abdominal wound dehiscence, including anti-infective wound dressings, antibiotics according to culture sensitivity and skin grafting. Even after implementation of various modes of treatment, failure rate is very high. Hence we planned to use collagen dressings for the treatment of abdominal wound dehiscence. Collagen plays a key role in each phase of wound healing as major extracellular matrix protein. It acts as a major scaffold for tissues, due to its stiff, triple stranded helical structure.[20,32]

In present prospective study, we included all the cases with postoperative abdominal wound dehiscence. We excluded the patients with Hypersensitivity to Collagen, All patients with incisional Hernia, patients who have developed evisceration and all patients with wound dehiscence on sites other than the abdomen.

We did collagen dressing in 25 patients (study group), and in control group standard dressings were done. In this study, the role of collagen dressings and standard dressings was evaluated to establish the comparison between the two dressing groups.

- The age of the patients included in this study ranged from 18-60 years. Mean age in study group and control group was 46.12 and 42.96 years respectively. Both the groups were comparable in age in our study (Table 1).
- Post operative abdominal wound dehiscence was more prevalent in males in both the groups (Table 2).
- Mean duration of post-op abdominal wound dehiscence was 5 days in control group and 4.84 days in study group. Both the groups were comparable in duration of post-op wound dehiscence (Table 4).
- Mean systolic and diastolic BP were 121.60 and 76.80 mm of Hg in control group and were 121.44 and 75.68 mm of Hg in study group. Both groups were comparable in blood pressure (Table 3).

- Mean wound size on day 1 was 1848.00 mm^2 in control group and 1258 mm^2 in study group. Both the groups were comparable in wound size.(Table 5)
- Mean Hb in control and study group was 9.04 g/dl and 9.77 g/dl respectively which was highly significant (p value=0.039). This indicates that healing response was good in patient with normal Hb (Table 3).
- Mean TLC in control and study group was 12916.0 and 14844.0 respectively. The values were highly significant indicating that lower the TLC levels higher the chances of healing without disruption (Table 3).
- Mean urea in control group was 25.32 mg/dl and 26.20 mg/dl in study group. Both the groups were comparable in urea levels (Table 3).
- Mean S. Albumin levels in control and study group was 3.30g/dl and 2.97 g/dl respectively. Which were highly significant (p value=0.006) (Table 3).
- There is no any specific type of incision leading to wound dehiscence (Table 11).
- The incidence of wound dehiscence in emergency operation (58%) is more in comparison to elective operation (42%)(Table 12).

In our present study, when we used collagen dressings, the response was very good i.e 3 patients had complete response, 10 had partial response and 12 patients had non complete response after 7 days of treatment, while in control group where we used standard dressings, complete response/ healing was not seen even in a single patient after 7 days (Table 7). In study group the complete response in 3 patients only could be explained on the basis of coexistence of other risk factors such as low Hb, high TLC, obesity and low S.Albumin levels that disrupts healing process and delays the wound healing.

We also assessed the healing rate after 14^{th} and 28^{th} day of treatment and compared the results with that of standard dressing group (control group) (Table 9 and 10). After 14 days of collagen treatment, 5 patients had complete response, 19 patients had partial healing response and only 1

patient had non complete response, which could be explained on the basis of low Hb and high TLC levels leading to poor tissue perfusion and delayed healing process. High TLC which is responsible for more bacterial recruitment and poor granulation tissue production at the wound site could be the explanation of noncomplete response in one patient of study group. When compared with control group, none of the patient had complete response after 14 days of treatment. The reason for absence of complete response in control group is lack of collagen which is the major constituent of extracellular matrix, that promotes healing process by stimulation of various growth factors and chemokines.

After collagen dressing treatment in study group on day $28^{th,}$, out of total 25 patients 20 patients had complete response while 5 patients had partial response, the reason for partial response in 5 patients was the coexistence of pre-operative obesity, hypertension and low platelet counts, that leads to disruption of healing process resulting in delayed healing. while in study group at the end of 28^{th} day , only 5 patients had complete response, 18 had partial and 2 had non complete response.

Partial and complete response was significantly higher in study group except at day 7^{th} as compared to control group (Table 7, 8, 9, and 10).

In abdominal wound dehiscence no such studies are available for comparison except some case reports.

Presence of hypertension, obesity, COPD, diabetes, anemia, hypoalbuminemia, hyponatremia and cough etc, all these factors influence wound healing process. In a study carried out at Oula University Hospital, out of 48 patients who had wound dehiscence, mortality was reported to be 4% (2 patients). The mean hospital stay was 25±15 days. 31 (65%) patients had pre-operative hypoalbuminemia; other risk factors included anemia, malnutrition, pulmonary complication and emergency procedure.[45,46]

Collagen dressings have very good results in our study. Collagen favours the outcome because of increased defense mechanism by stimulating and

differentiation of early and late granulocytes, erythroid and megakaryocyte precursor cells. Side effects of collagen are generally infrequent and if present are very mild that can be tolerated by the patients.

Till date, there is no doubt that collagen is a costly treatment in our country, but if we consider the cost of hospitalization and if we want to prevent high rate of morbidity and mortality then this treatment is very cost effective. No doubt this study has its own limitations as small cohort and cost of treatment. To confirm our results, more studies in large cohort are required.

SUMMARY AND CONCLUSION

The present prospective study was conducted in the department of general surgery, Dayanand medical college and Hospital, Ludhiana between October 2017 to may 2019. The study included total of 50 cases comprising of 25 patients in study group and 25 in control group. An attempt was made to compare the role of collagen dressings with standard dressings in post operative abdominal wound dehiscence.

Both the groups were thoroughly interrogated clinically and relevant investigations were performed critical analysis of variables in two were done by computer using statistical software. The salient points of the results on the basis of observation made in the present study and conclusion drawn are as follows:

1. Majority of patients with abdominal wound dehiscence presented in 4^{th} and 5^{th} decade of life. The mean age of patients was found to be 46.12 years in standard dressing group and 42.96 years in collagen dressing group.
2. A slight male preponderance was noted with male to female ratio of 2.3:1.
3. There was statistically significant difference between the result of collagen and standard dressings as collagen dressings has better healing response rate as compared to standard ones.
4. Duration of wound dehiscence and size of dehiscence also significantly influence the healing process.
5. Association with other co-morbidities such as diabetes, smoking, obesity and anemia etc has significant adverse affect on healing process leading to disrupted and prolonged healing.
6. Leucocytosis and low platelet account along with hypoalbuminemia again slows down the healing process leading to increased chances of surgical site infection.

7. Patient’s awareness and aggressive treatment should be the aim of the treating surgeon with no compromise to the patient’s life.

Abdominal wound dehiscence is as old as surgery. Predisposing factors are either patient or surgeon related. Despite several incisions and suture materials, controversy remains, with no consensus on the ideal methods or materials for closure of abdominal wounds to prevent dehiscence.

In conclusion, the data thus obtained indicates that collagen dressings are more use full in promoting healing process and are reliable in abdominal wound dehiscence. On the other hand standard dressings are less efficacious in abdominal wound dehiscence.

BIBLIOGRAPHY

1. Fleischer GM, Rennert A, Ruhmer M. Infected abdominal wall and burst abdomen. Der Chirurg Germany. 2000;71:754–62.
2. Krishna N MM, Kumar KS, Prasad GL. A Nested Case Control Study of the Abdominal Wound Dehiscence in a Rural Hospital in South India. Int J Dent Med Sci. 2016;15:31-48.
3. Greenblatt DY, Rajamanickam V, Mell MW. Predictors of surgical site infection after open lower extremity revascularization. J Vasc Surg. 2011;54:433-39.
4. Foustina Mary C, Chudar A, Karthikeyan R. A clinical study of abdominal wound dehiscence and management. J Evid Based Med Healthc. 2019:6:2171-5.
5. Greenall MJ, Evans M, Pollock AV. Midline or transverse laparotomy? A random controlled clinical trial. Part I: influence on healing. Br J Surg. 1980;67:188-90.
6. Gonzalez AC, Costa TF, Andrade ZA, Medrado AR. Wound healing - A literature review. An Bras Dermatol. 2016;91:614-20.
7. Shaw TJ, Martin P. Wound repair at a glance. J Cell Sci. 2009;122:3209-13.
8. Eming SA, Krieg T, Davidson JM. Inflammation in wound repair molecular and cellular mechanisms. J Invest Dermatol. 2007;127:514-25.
9. Li J, Chen J, Kirsner R. Pathophysiology of acute wound healing. Clin Dermatol. 2007;25:9-18.
10. Velnar T, Bailey T, Smrkolj V. The wound healing process: an overview of the cellular and molecular mechanisms. J Int Med Res. 2009;37:1528-42.
11. Van Ramshorst GH, Eker HH, van der Voet JA, Jeekel J, Lange JF. Long-term outcome study in patients with abdominal wound dehiscence: a comparative study on quality of life, body image, and

incisional hernia. Journal of Gastrointestinal Surgery. 2013;17:1477-84.

12. Correa NFM, De Brito MJA, De Carvalho R. Impact of surgical wound dehiscence on health-related quality of life and mental health. J Wound Care. 2016;25:561-70.
13. Kenig J, Richter P, Zurawska S. Risk factors for wound dehiscence after laparotomy – clinical control trial. Polish J Surg. 2012;84:565-73.
14. Harris CL, Kuhnke J, Haley J. Best practice recommendation for the prevention and management of surgical wound complications. Wounds Canada. 2017.
15. Tarzia V, Carrozzini M, Bortolussi G, Buratto E, Bejko J, Comisso M, Mescola V, Penzo V, Guarino M, De Franceschi M, Pagnin C. Impact of vacuum-assisted closure therapy on outcomes of sternal wound dehiscence. Interactive cardiovascular and thoracic surgery. 2014;19:70-5.
16. Mutwali IM. Incisional hernia: risk factors, incidence, pathogenesis, prevention and complications. Sudan Med Monitor. 2014;9:81-6.
17. Jain S, Tote DS, Kolte G, Jajoo S, Tote S. Effect of moist dressing, collagen sheet dressing and epidermal growth factor in healing of chronic wounds. International Surgery Journal. 2017;4:2594-9.
18. Kunugiza Y, Tomita T, Moritomo H, Yoshikawa H. A hydrocellular foam dressing versus gauze: effects on the healing of rat excisional wounds. J Wound Care. 2010;19:15-21.
19. Tauro LF, Ravikrishnan J, Rao S, Divakar SH, Shetty SR, Menezes LT. A comparative study of the efficacy of topical negative pressure moist dressings and conventional moist dressings in chronic wounds. Indian Journal of Plastic Surgery. 2007;40:133-140.
20. Hart J, Silcock D, Gunnigle S. The role of oxidised regenerated cellulose/ collagen in chronic wound repair: effects in vitro on fibroblast biology and in vivo in a model of compromised healing. Int J Biochem Cell Biol. 2002;34:1557–70.

21. Nataraj C, Ritter G, Dumas S, Helfer FD, Brunelle J, Sander TW. Novel stabilization and sterilization method for collagen-based biologic wound dressings. Wounds. 2004;19:148-56.
22. Jehle KS, Rohatgi A, Baig MK. Use of porcine dermal collagen graft and topical negative pressure on infected open abdominal wounds. J Wound Care. 2007;16:36-7.
23. Rodero MP, Khosrotehrani K. Skin wound healing modulation by macrophages. Int J Clin Exp Pathol. 2010;3:643-53.
24. Chattopadhyay S, Raines RT. Collagen-Based Biomaterials for Wound Healing. Biopolymers. 2014;101:821-33.
25. Rivera AE, Spencer JM. Clinical aspects of full thickness wound healing. Clin Dermatol. 2007;25:39-48.
26. Toy LW. Matrix metalloproteinases: their function in tissue repair. J Wound Care. 2005;14:20-2.
27. Centers for Disease Control and Prevention (CDC). Surgical site infection (SSI) event. Procedure-associated module. 2017.
28. Wolcott R, Fletcher J. The role of wound cleansing in the management of wounds. Int J Wounds. 2014;1:25-31.
29. Fernandez R, Griffiths R. Water for wound cleansing. Cochrane Database Syst Rev. 2012;15:118-125.
30. Weiss EA, Oldham G, Lin M, Foster T, Quinn JV. Water is a safe and effective alternative to sterile normal saline for wound irrigation prior to suturing: a prospective, double-blind, randomised, controlled clinical trial. BMJ open. 2013;3:e001504.
31. Hodgetts KS, Carville K, Leslie GD. Determining risk factors for surgical wound dehiscence: a literature review. Int Wound J. 2015;12:265-75.
32. Barie PS, Wilson SE. Impact of evolving epidemiology on treatments for complicated skin and skin structure infections: the surgical perspective. J Am Coll Surg. 2015;220:105-6.

33. Anderson DJ, Chen LF, Sexton DJ, Kaye KS. Complex surgical site infections and the devilish details of risk adjustment: important implications for public reporting. Infect Control Hosp Epidemiol. 2008;29:941-6.
34. Klevens RM, Edwards JR, Richards Jr CL, Horan TC, Gaynes RP, Pollock DA, et al. Estimating health care-associated infections and deaths in US hospitals, 2002. Public health reports. 2007;122:160-6.
35. Magill SS, Edwards JR, Bamberg W, Beldavs ZG, Dumyati G, Kainer MA, et al. Multistate point-prevalence survey of health care–associated infections. New England Journal of Medicine. 2014;370:1198-208.
36. Kaye KS, Schmader KE, Sawyer R. Surgical site infection in the elderly population. Clin Infect Dis. 2004;39:1835-41.
37. Boltz MM, Hollenbeak CS, Julian KG, Ortenzi G, Dillon PW. Hospital costs associated with surgical site infections in general and vascular surgery patients. Surgery. 2011;150:934-42.
38. Azoury SC, Farrow NE, Hu QL, Soares KC, Hicks CW, Azar F, et al. Postoperative abdominal wound infection–epidemiology, risk factors, identification, and management. Clinical wound care management and research. 2015;2:137-48.
39. Segal CG, Waller DK, Tilley B, Piller L, Bilimoria K. An evaluation of differences in risk factors for individual types of surgical site infections after colon surgery. J Surg. 2014;156:1253-60.
40. Ogawa R, Akaishi S, Huang C, Dohi T, Aoki M, Omori Y, et al. Clinical applications of basic research that shows reducing skin tension could prevent and treat abnormal scarring: the importance of fascial/subcutaneous tensile reduction sutures and flap surgery for keloid and hypertrophic scar reconstruction. Journal of Nippon Medical School. 2011;78:68-76.
41. Hochberg J, Meyer KM, Marion MD. Suture choice and other methods of skin closure. Surg Clin N Am. 2009;89:627-41.

42. Van Ramshorst GH, Neiuwenhuizen J, Hop WCJ. Abdominal wound dehiscence in adults: development and validation of a risk model. World J Surg. 2010; 34: 20-7.
43. Dennis C, Sethu S, Nayak S. Suture materials – current and emerging trends. J Biomed Mat Res A. 2016;104:1544-59.
44. Mir MA, Manzoor F, Singh B, Sofi IA, Rameez AZ, Farooq SI. Development of a risk model for abdominal wound dehiscence. Surgical Sci. 2016;7:466-74.
45. Thomas Hess C. Checklist for factors affecting wound healing. Adv Skin Wound Care. 2011;24:192.
46. Webster C, Neumayer L, Smout R, Horn S, Daley J, Henderson W, et al. Prognostic models of abdominal wound dehiscence after laparotomy. Journal of Surgical Research. 2003;109:130-7.
47. Leaper D, Burman-Roy S, Palanca A, Cullen K, Worster D, Gautam-Aitken E, et al. Prevention and treatment of surgical site infection: summary of NICE guidance. Bmj. 2008;337:a1924.
48. Riou JP, Cohen JR, Johnson H Jr. Factors influencing wound dehiscence. Am J Surg. 1992;163:324-30.
49. Webster C, Neumayer L, Smout R, Horn S, Daley J, Henderson W, et al. Prognostic models of abdominal wound dehiscence after laparotomy. J Surg Res. 2003;109:130-7.
50. Hopf HW, Hunt TK, West JM. Wound tissue oxygen tension predicts the risk of wound infection in surgical patients. Arch Surg. 1997;132:997-1004.
51. Jensen JA, Goodson WH, Hopf HW, Hunt TK. Cigarette smoking decreases tissue oxygen. Arch Surg. 1991;126:1131-4.
52. Makela JT, Kiviniemi H, Juvonen T, Laitinen S. Factors influencing wound dehiscence after midline laparotomy. Am J Surg. 1995;170:387-9.
53. Israelsson LA, Jonsson T. Overweight and healing of midline incisions. Eur J Surg. 1997;163:175-80.

54. Grantcharov TP, Rosenberg J. Vertical compared with transverse incision in abdominal surgery. Eur J Surg. 2001;167:260-7.
55. Althumairi AA, Canner JK, Gearhart SL, Safar B, Fang SH, Wick EC, et al. Risk factors for wound complications after abdominoperineal excision: analysis of the ACS NSQIP database. Colorectal Disease. 2016;18:260-6.
56. Kim JYS, Khavanin N, Jordan SW. Individualized risk of surgical site infection: an application of the breast reconstruction risk assessment score. Plast Reconstr Surg. 2014;134:351-62.
57. Sandy-Hodgetts, K, Ousey K, Howse E. Ten top tips: management of surgical wound dehiscence. Int J Wounds. 2017;8:11-4.
58. Sandy-Hodgetts K. Clinical innovation: the Sandy Grading System for surgical wound dehiscence classification – a new taxonomy. Wounds International. 2017;8:6-11.
59. Boateng JS, Matthews KH, Stevens HNE, Eccleston GM. Wound Healing Dressings and Drug Delivery Systems: A Review. Indian J Pharml Sci. 2008;97:2892-923.
60. Dhivya S, Padma VV, Santhini E. Wound dressings - a review. Biomedicine. 2015;5:22.
61. Thomas A, Harding KG, Moore K. Alginates from wound dressings activate human macrophages to secrete tumour necrosis factor-a. Biomaterials. 2000;21:1797-802.
62. Sandy-Hodgetts K, Carville K, Santamaria N, Parsons R, Leslie GD. The Perth Surgical Wound Dehiscence Risk Assessment Tool (PSWDRAT): development and prospective validation in the clinical setting. Journal of wound care. 2019;28:332-44.
63. Kecelj Leskovec N, Perme MP, Jezeršek M, Mozina J, Pavlović MD, Lunder T. Initial healing rates as predictive factors of venous ulcer healing: the use of a laser-based three-dimensional ulcer measurement. Wound repair and regeneration. 2008;16:507-12.

64. Pavlovcic U, Diaci J, Mozina J, Jezersek M. Wound perimeter, area, and volume measurement based on laser 3D and color acquisition. Biomedical engineering online. 2015;14:39.
65. Flanagan M. Wound measurement: can it help us to monitor progression to healing?. J Wound Care. 2003;12:189-94.
66. Little C, McDonald J, Jenkins M, McCarron P. An overview of techniques used to measure wound area and volume. J Wound Care. 2009;18:250-3.
67. Quinn JV, Wells GA. An assessment of clinical wound evaluation scales. J Acad Emg Med. 1998;5:583-6.
68. Alvarez O, Hefton JM, Eaglestein EW. Healing wounds: occlusion or exposure. Infection in Surg 1984;3:173-81.
69. Cone JB. Inflammation. Am J Surg. 2001;182:558-662.
70. Alvarez O, Mertz PM, Raglestein WH. The effect of occlusive dressings on collagen synthesis and epithelization in superficial wounds. J Surg Res. 1983;35:142-8.
71. Tomaseck JT, Hey ED, Fujiware K. Collagen modulates cell shape and cytosleleton of embryonic corneal and fibroma and fibroblasts. Developmental Biology. 1982;92:107-22.
72. Hunt TK. The physiology of wound healing. Ann Emg Med. 1988;17:1265-73.
73. Veves A, Sheehan P, Pham HT. A randomized controlled trial of promogram (a collagen/ oxidized regenerated cellulose dressings) vs standard treatment in management of diabetic foot ulcers. Arch Surg 2002;137: 882-7.
74. Donaghue VM, Chrzan JS, Rosenblum BI, Giurini JM, Habershaw GM, Veves A. Evaluation of a Collagen-Alginate Wound Dressing in the Management. J Wound Care. 1998;11:114-8.
75. Singh O, Gupta SS, Soni M, Moses S, Shukla S, Mathur RK. Collagen dressing versus conventional dressings in burn and chronic wounds: a retrospective study. J Cutan Aesthet Surg. 2011;4:12-6.

76. Rao H, Pai A, Hussein I, Arun A, Ram HS, Pai A, et al. A comparative study between collagen dressings and conventional dressings in wound healing. Int J Collab Res Internal Med Publ Health. 2012;4:611-23.
77. Kolenik SA, McGovern TW, Leffell DJ. Use of a Lyophilized Bovine Collagen Matrix in Postoperative Wound Healing. Dermatol Surg. 1999;24:303-7.
78. Lakshmi G, Ravimohan TR. Post Laparotomy Abdominal Wound Dehisence – A Study in Tertiary Care Hospital. Int J Contemp Med Res. 2018;5:77-8.
79. Soni P, Haripriya VB, Haripriya A, Dutt V. Burst Abdomen: A Post-operative Morbidity. Int J Scientific Study. 2015;3:175-8.
80. Mary CF, Chudar A, Karthikeyan R. A clinical study of abdominal wound dehiscence and management. J Evid Based Med Health. 2019;6:2171-5.
81. Kapoor KK, Hassan Mir MN. A clinical study of abdominal wound dehiscence with emphasis on surgical management in Bangalore medical college and research institute, Karnataka, India. Int J Surg. 2017;4:134-40.
82. Walming S, Angenete E, Block M, Bock D, Gessler B, Haglind E. Retrospective review of risk factors for surgical wound dehiscence and incisional hernia. BMC Surg. 2017;17:19-25.
83. Afzal S, Bashir MM. Determinants of wound dehiscence in abdominal surgery in public sector hospital. Annals of Surg. 2008;14:110-5.

Picture 1: Wound status on day 1 of collagen dressing

Picture 2: Wound status on day 1 standard dressing

Picture 3: Wound status on day 28 after collagen dressing

Picture 4: Wound status on day 28 after standard dressing

Case No	Group	Name	Age	Sex	Ad. No	TYPE OF SURGERY	DOA	DOD	BP (mm of Hg)		HEMOGRAM			RFT		S. Albumin	type of incision	time of dehiscence	SIZE AT DAY1		SIZE AT DAY28		Treatment		RESULTS			
									systolic	diastolic	Hb	Platelets	TLC	UREA	Creatinine				Lx B	In Sq.mm	LxB	In Sq.mm	St. Dressing	collagen		DAY 7	DAY 14	DAY 28
1	T	C	60	Male	386557	EL	11/12/2017	30/12/17	100	68	10.8	300	11000	28	0.65	1.86	V	6th day	50x40	2000	30x20	600	NO	YES	NR	NCR	PR	PR
2	T	G	59	Male	217984	EM	31/12/17	11/1/2018	130	86	10	400	9000	26	0.6	3	V	4th day	20x20	400	14x10	140	NO	YES	NR	PR	PR	CR
3	T	K	36	Female	363415	EL	5/1/2018	23/1/18	100	64	11.2	290	19800	22	0.88	2.9	V	5th day	80x30	2400	64x25	1600	NO	YES	NR	PR	PR	CR
4	T	MP	60	Male	271586	EL	18/1/18	27/1/18	130	80	11.8	190	12000	25	0.9	3.8	V	6th day	110x40	4400	86x18	1548	NO	YES	NR	NCR	PR	CR
5	T	KS	26	Male	424395	EM	20/1/18	8/2/2018	124	78	12	90	18600	23	0.68	3.5	V	4th day	105x46	5290	45x09	405	NO	YES	NR	NCR	NCR	PR
6	T	GS	45	Male	429929	EM	30/1/18	15/2/18	140	90	8	150	16700	18	0.91	3.2	V	5th day	68x45	3060	20x4	80	NO	YES	NR	NCR	PR	CR
7	T	OD	50	Female	420634	EL	30/1/18	10/2/2018	120	70	8.4	280	12000	22	0.89	3.8	V	5th day	30x20	600	20x4	80	NO	YES	NR	CR	CR	CR
8	T	C	56	Male	269971	EL	7/3/2018	3/4/2018	138	74	10.7	534	18900	26	0.98	2	V	4th day	90x40	3600	40x18	720	NO	YES	NR	NCR	PR	CR
9	T	BS	45	Male	462235	EL	21/3/18	29/3/18	126	76	7.6	294	16000	46	2.2	1.86	V	3rd day	100x30	3000	76x16	1216	NO	YES	NR	NCR	PR	PR
10	T	KD	60	Male	464055	EM	23/3/18	3/4/2018	140	90	8.8	445	17500	34	1.2	2.87	V	4th day	40x20	800	20x13	260	NO	YES	NR	PR	CR	CR
11	T	SS	45	Male	250084	EM	9/4/2018	17/4/18	120	76	10	394	12000	24	1.1	3	T	5th day	40X20	800	10x5	50	NO	YES	NR	NCR	PR	CR
12	T	MK	29	Female	476031	EM	16/4/18	24/4/18	120	70	8.2	196	12900	28	1.15	2.9	V	8th day	90x45	4050	60x25	1500	NO	YES	NR	CR	CR	CR
13	T	AK	50	Male	481577	EM	19/4/18	1/5/2018	160	90	11	305	16000	36	2.1	3.2	V	7th day	20x30	600	18x14	252	NO	YES	NR	PR	PR	CR
14	T	SK	19	Female	483655	EL	22/4/18	1/5/2018	100	60	10.8	360	11000	18	0.68	3.4	V	5th day	30x10	300	00x00	0	NO	YES	NR	CR	PR	CR
15	T	KS	60	Male	489085	EM	2/5/2018	12/5/2018	120	70	10	365	21000	20	1.4	3	V	7th day	30x20	600	20x16	320	NO	YES	NR	NCR	PR	CR
16	T	GS	59	Male	491065	EM	3/5/2018	12/6/2018	100	60	9.8	190	18000	40	1.6	2.9	V	5th day	140x40	5600	70x12	840	NO	YES	NR	NCR	PR	PR
17	T	RL	38	Male	495960	EL	10.05.18	01.06.18	100	68	9	130	11000	20	0.68	3.2	T	6th day	20x10	200	12x8	96	NO	YES	NR	NCR	CR	CR
18	T	HS	28	Male	499283	EL	15.05.18	24.05.18	120	70	10	284	10000	40	1.2	2.95	T	5th day	20x10	200	14x4	56	NO	YES	NR	PR	PR	CR
19	T	DR	53	Male	505817	EM	24.05.18	01.06.18	104	76	10.2	190	11000	24	0.8	3.2	V	5th day	35X10	350	20x6	80	NO	YES	NR	NCR	PR	CR
20	T	RK	45	Male	505775	EM	26.05.18	11.6.18	130	80	9.6	284	18000	20	0.89	3.2	V	6th day	30x10	300	22x8	176	NO	YES	NR	PR	PR	CR
21	T	VM	40	Male	456250	EL	05.06.18	14.06.18	100	70	10.8	390	14800	20	1.1	3.1	V	4th day	38X15	570	18x4	72	NO	YES	NR	PR	PR	CR
22	T	PD	60	Female	517804	EL	11.06.18	18.06.18	114	70	9	403	9700	26	1.4	2.9	V	4th day	20x20	400	10x10	100	NO	YES	NR	PR	PR	CR
23	T	RS	25	Male	534542	EL	08.07.18	27.07.18	140	90	6.8	200	23200	26	1.76	2.6	V	3rd day	120x90	1080	90x55	4950	NO	YES	NR	NCR	PR	PR
24	T	NK	45	Female	460634	EL	04.08.18	18.08.18	120	76	8.9	280	14000	20	1.1	3.1	T	4th day	22X20	4400	12x10	120	NO	YES	NR	PR	CR	CR
25	T	A	60	Male	554010	EM	13.08.18	23.08.18	140	90	10.8	290	17000	23	0.89	2.89	V	5th day	40x30	1200	20x14	280	NO	YES	NR	PR	PR	CR
26	C	SD	52	Female	580562	EM	13/9/18	10/10/2018	150	90	10	220	19000	46	1.8	3	V	4th day	75x28	2100	31x14	434	YES	NO	NR	NCR	NCR	PR
27	C	JK	53	Female	586803	EL	21/9/18	8/10/2018	110	76	8.6	280	12000	30	0.68	3.4	T	5TH day	50x35	1750	34x26	884	YES	NO	NR	NCR	NCR	PR
28	C	SK	59	Female	575503	EL	27/09/18	9/10/2018	130	90	9.6	280	12300	18	0.88	3.2	V	5th day	30x20	600	24x14	336	YES	NO	NR	NCR	PR	PR
29	C	IA	29	Male	595104	EM	4/10/2018	15/10/18	130	80	9	240	14000	26	1.2	3.5	V	4th day	40x20	800	28x18	504	YES	NO	NR	NCR	PR	PR
30	C	RP	40	Male	595940	EM	5/10/2018	13/10/18	126	76	9.4	280	12300	26	0.8	3.2	V	6th day	70x40	2800	55x30	1650	YES	NO	NR	NCR	PR	PR
31	C	PS	38	Male	601660	EM	14/10/18	25/10/18	110	76	8.6	340	12400	28	1.68	3.4	V	5th day	30x22	660	24x12	288	YES	NO	NR	NCR	PR	CR
32	C	GS	18	Male	623486	EM	20/11/18	29/11/18	130	76	8	299	14000	32	0.8	3	V	4th day	30x10	300	22x8	176	YES	NO	NR	NCR	NCR	NCR
33	C	BS	55	Male	623388	EL	20/11/18	3/12/2018	130	76	7.6	380	9000	26	1.08	3.2	V	4th day	40x20	800	26x14	364	YES	NO	NR	PR	PR	CR
34	C	UD	45	Male	627019	EM	27/11/18	17/12/18	100	68	9.2	340	11400	28	0.68	3.8	V	5TH DAY	40X22	880	34x14	476	YES	NO	NR	NCR	NCR	NCR
35	C	N	26	Female	637253	EM	14/12/18	26/12/18	110	78	8.8	280	14000	24	0.68	3.6	V	5th day	30x20	600	24x16	384	YES	NO	NR	PR	PR	PR
36	C	KK	20	Female	639658	EL	18/12/18	24/12/18	108	64	7.8	350	8900	26	1.4	3.2	V	4th day	30X20	600	20x12	240	YES	NO	NR	NCR	NCR	PR
37	C	BS	48	Male	643393	EM	26/12/18	5/1/2019	130	80	8.6	274	14700	8	0.68	3.8	V	5th day	30x20	600	24x18	432	YES	No	NR	NCR	NCR	PR
38	C	DL	58	Male	591959	EL	3/1/2019	15/01/19	130	84	10	484	15000	28	1.4	3	V	5th day	30x20	600	20x10	200	YES	NO	NR	NCR	NCR	PR
39	C	SK	30	Female	649915	EM	7/1/2019	14/1/19	98	60	9	230	11000	18	0.68	3.4	T	6th day	20x20	400	16x14	224	YES	NO	NR	PR	PR	PR
40	C	SR	60	Female	651772	EL	11/1/2019	22/1/19	130	76	9.6	154	14000	40	1.1	3	T	5th day	120x40	4800	80x10	800	YES	NO	NR	NCR	NCR	PR
41	C	S	26	Female	650162	EL	19/1/19	26/1/19	100	68	9	370	13000	16	0.88	3.4	V	4th day	10x10	100	8x8	64	YES	NO	NR	PR	PR	CR
42	C	GS	60	Male	282483	EM	26/1/19	13/2/19	140	90	8	290	12400	28	1	3	T	5th day	100x30	3000	86x24	2064	YES	NO	NR	NCR	NCR	PR
43	C	S	45	Male	6661846/2/19	EM	6/2/2019	15/2/19	108	64	9	300	12300	14	0.5	3.8	V	7th day	26x26	676	20x20	400	YES	NO	NR	NCR	NCR	PR
44	C	AM	29	Male	634695	EL	24/2/19	7/3/2019	110	68	10.4	180	14000	26	0.6	3.4	T	6th day	20x10	200	16x08	128	YES	NO	NR	NCR	NCR	PR
45	C	PS	37	Male	694875	EM	24/3/19	4/4/2019	140	90	11	240	11000	36	1.2	3.6	V	4th day	120x40	4800	100x28	2800	YES	NO	NR	NCR	NCR	PR
46	C	DS	49	Male	628931	EM	29/3/19		140	84	8	290	10000	18	1.2	2.94	V	3rd day	80x30	2400	60x26	1560	YES	NO	NR	NCR	NCR	PR
47	C	SK	56	Female	698049	EM	29/3/19	12/4/2019	120	70	9	160	12400	26	0.88	3.2	V	6th day	30X20	600	24x16	384	YES	NO	NR	PR	PR	CR
48	C	TS	54	Male	704204	EM	6/4/2019	22/4/19	130	82	6.4	290	17000	23	0.96	3.2	V	4th day	10x40	400	08x30	240	YES	NO	NR	NCR	NCR	PR
49	C	DK	30	Male	564141	EM	6/5/2019	17/5/19	110	76	10.4	305	14400	24	0.48	3	V	6th day	20x10	200	16x08	128	YES	NO	NR	NCR	NCR	PR
50	C	GS	57	Male	735845	EM	25/5/19	31/5/19	120	78	11	240	12400	18	1	3.2	V	4th day	40x20	800	32x12	384	YES	NO	NR	NCR	PR	CR

Baba Farid University
of Health Sciences
Sadiq Road
Faridkot-151 203 (Pb). INDIA.
Phone : 01639-256232,256236
Tele/Fax : 01639-256235
Email – Examination@bfuhs.ac.in

No. BFUHS/2K18p-TH/ 15711 Date 12/11/18

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 31.08.2018 has approved the plan of thesis of Inderpreet Singh, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
A comparative study of standard dressing vs collagen dressing in post operative abdominal wound dehiscence

Supervisor
Dr. Munish Trehan
Assoc. Prof.,
Dept. of Surgery,
DMCH, Ludhiana.

Co-Supervisor
Dr. Jaspal Singh
Prof. & Head,
Dept. of Surgery,
DMCH, Ludhiana.

Dr. Sanjeev Singla
Prof.,
Dept. of Surgery,
DMCH, Ludhiana..

The student may submit the four copies of thesis, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

Dr. S P Singh, MS(Oph)
Controller of Examinations

Note :
1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

M.S

in

Surgery

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

JANUARY, 2018

DR. INDERPREET SINGH

DEPARTMENT OF SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE
For the degree of	M.S. in General Surgery
Name of the candidate	Dr. Inderpreet Singh
Supervisor	Dr. Munish Trehan, Associate Professor, Department of Surgery, DMC&H, Ludhiana
Co-supervisor	Dr. Jaspal Singh, Professor & Head, Department of Surgery, DMCH, Ludhiana Dr. Sanjeev Singla, Professor, Department of Surgery, DMC&H, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Post Operative wound dehiscence also known as surgical site infections (SSI's) wound dehiscence can cause painful lengthy hospital stay, multiple stages of surgeries, permanent disabilities, prolonged rehabilitation. To tackle these tissues, wound dressing plays a important role. Collagen is an endogenous substance which appears to be a good material for use as biomedical implantable device & which forms a matrix for regenerating tissue.

Aim of Study: a) To compare standard vs collagen dressings in postoperative abdominal wound dehiscence. b) To document the outcome of patients with post operative abdominal wound dehiscence. c) To study the type of incision leadng to wound dehiscence. d) To study the incidence of wound dehiscence in elective and emergency operation.

Materials & Methods: Information will be collected via predesigned proforma, complete clinical examination will be done & wound perimetry will be analysed in control & test group in this comparative study (extending from Dec 2017 to Dec 2019). All patients with post operative abdominal wound dehiscence after any abdominal incision in a age group between 18 to 60 years will be included. Patients unwilling for study or more 60 years as less than 15 years & patients who are hypersensitive to collagen are excluded.

Clinical Significance: Clinical Significance of this comparative study will help to evaluate about the difference in hospital stay to patient, healing time of wound with both types of dressing as well as cost effectiveness in both of dressings and final outcome of post operative abdominal wound dehiscence.

Keywords: Abdominal wound dehiscence, Post operative dehiscence, collagen dressings, wound dehiscence, surgical site infections, collagen dressings outcome.

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE"** exist in the Department of Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. Munish Trehan
Associate Professor
Department of Surgery
DMCH, Ludhiana

Co-Supervisor(s)

Dr. Jaspal Singh
Professor & Head
Department of Surgery
DMCH, Ludhiana

Dr. Sanjeev Singla
Professor
Department of Surgery
DMCH, Ludhiana

Dr. Jaspal Singh
Professor & Head
Department of Surgery
DMCH, Ludhiana

Place : DMCH, Ludhiana

Date : 28/1/18.

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Inderpreet Singh
Department	Surgery
Topic of Thesis	A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE
Likely date of appearing in PG examination	MAY 2020
Date of enrollment	31st May, 2017
Name of Head of Department	Dr. Jaspal Singh
1) Supervisor **2) Co-Supervisor(s)**	Dr. Munish Trehan Dr. Jaspal Singh Dr. Sanjeev Singla
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HOD SPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
	7. HOD Obst. & Gynae
	8. Legal Expert
	9. Secretary, IEC
	10. Dean Academics
	11. Vice Principal
	12. Principal

Approved: Yes / No

Chairperson
Research Committee

Chairperson
Research Committee

Approved: Yes / No

Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR. INDERPREET SINGH , VPO POHIR, DISTT.LUDHIANA STATE PUNJAB .
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL, LUDHIANA (PUNJAB)
3	COURSE OF STUDY AND SUBJECT	M.S. GENERAL SURGERY
4	DATE OF ADMISSION OF COURSE	31.05.2017
5	TITLE OF THE TOPIC	A COMPARATIVE STUDY OF STANDARD DRESSING Vs COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE"

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Wound healing is complex process involving a number of chemical and biological events. Wound dehiscence addressed by various names like wound failure, disruption, burst abdomen is a multifactorial problem. The understanding of wound healing and dehiscence are complicated considerably by the fact that it is uncommon for any factor to exist in isolation and to determine which factor is of greatest importance in a particular case becomes a difficult task indeed. Postoperative wound dehiscence also known as surgical site infections, complicate the recovery course of many patients. As defined by the centres for disease control and prevention/ these infections typically occur within 30 days of an operation.

Overall, it is estimated that abdominal wound dehiscence occur following 1%-3% of all surgical procedures and accounts for approximately 2.0% of deaths due to health care associated infections. With regard to abdominal surgery the rate of wound infection may be much higher, with several prospective studies reporting an incidence of 15%-25% depending upon level of infection. The wound dehiscence can cause painful lengthy hospital stay, multiple stages of surgeries, permanent disability, prolonged rehabilitation. Therefore, to tackle these issues, wound dressings plays one of the important roles. It is therefore appropriate that the process and problems of wound healing should be vigorously addressed by all practitioners.

An ideal dressing used in the wound management should be economical, easy to apply, readily available dressing or method that will provide good pain relief, protect wound from infection, promote healing, keep

moisture, be elastic and non antigenic and adhere well to the wound and waiting for spontaneous epithilisation and healthy granulation.among newer type of wound dressings- Biological dressings like collagen create the most physiological interface between the wound surface, environment and impermeable to bacteria.

Collagen is an endogenous substance, which appears to be a good material for use as a biomedical implantable device and is used to form a matrix for regenerating tissue outside of the body . Collagen dressing has better advantage over conventional dressing in terms of collagen formation with greater reduction in inflammatory cells during healing days, whereas conventional dressing has minimal exudates formation resulting in increased days of healing.

In view of paucity of literature, the purpose of present study is to compare efficacy of conventional versus collagen dressings in abdominal wound dehiscence.

This study to be conducted in the department of General Surgery in Dayanand medical college and Hospital will review the management and outcome of patients with diagnosis of post operative abdominal wound dehiscence.

6.2 REVIEW OF LITERATURE

Wound dehiscence is a mechanical failure of wound healing, remains a problem and it can be affected by multiple factors. The normal wound healing process has been identified as involving three overlapping major phases:

•In first flammation, with cascades of processes that can further subdivided into early (first 24 hours) and late phase (upto 72 hours)

•Regeneration

•Maturation

The development of wound dehiscence depends on contamination of wound at end of surgical procedure and specifically relates to pathogenecity and inoculum of microorganisms present, balanced against the host's response. The microorganisms that are responsible for delayed wound healing are usually derived from patient (endogenous infection). Staphylococcus aureus is the most commonly responsible for organism.

The proper wound healing demands oxygen consumption, normoglycaemia and absence of toxic or septic factors, which reduces collagen synthesis and oxidative killing mechanisms of neutrophils. Wounds heal by primary, secondary or tertiary intention, wounds that approximated heal by primary intention by deposition of connective tissue which is necessary to fill the wound. Mortality rates associated with dehiscence have been reported between 14% to 50%.

A number of studies are done to compare the efficacy of collagen and conventional dressings in wound dehiscence.

•Veves A, Sheehan P, Pham HT7 [1] In a randomized, controlled trial of Promogran (a collagen /oxidized regenerated cellulose dressing) vs standard treatment in the management of diabetic foot ulcers by Veves A, Sheehan P, Pham HT7,1in patients with ulcers of less than 6 months' duration, 43 (45%) of 95 Promogran-treated patients healed compared with 29 (33%) of 89 controls (P =.056). In the group with wounds of at least 6 months' duration, similar numbers of patients healed in the control (10/49 [20%]) and the Promogran (8/43 [19%]; P =.83) groups. No differences were seen in the safety measurements between groups. Patients and investigators expressed a strong preference for Promogran compared with moistened gauze.

•Donaghue VM, Chrzan JS, Rosenblum BI, Giurini JM, Habershaw GM, Veves A [2] In this study, wound size, when averaged over the 8-week period and with the duration of the ulcer taken into account, was reduced significantly in the collagen-alginate dressing group, as compared with the gauze dressing group (df = 1, p =.0049). It is concluded that the collagen-alginate test dressing is as or more effective and safe as the currently used treatment.

•Singh O, Gupta SS, Soni M, Moses S, Shukla S, Mathur RK. [3] In a study conducted in patients with chronic wounds at Department of Surgery, MGM Medical College and MY Hospital, Indore, India, with two weeks of treatment, 60% of the 'collagen group' wounds and only 42% of the 'conventional group' wounds were sterile (P=0.03). Healthy granulation tissue appeared earlier over collagen-dressed wounds than over conventionally treated wounds (P=0.03). After eight weeks, 52 (87%) of 'collagen group' wounds and 48 (80%) of 'conventional group' wounds were >75% healed (P=0.21). Eight patients in the 'collagen group' and 12 in the 'conventional group' needed

partial split-skin grafting (P=0.04). Collagen-treated patients enjoyed early and more subjective mobility.

•Dr. Harish Rao, Dr. Ashwin Pai, Dr. Irshad Hussein, Dr. HS Shankar Ram, Dr. Sheila R Pai, and Dr. Shobha Pai. [4] A Comparative Study between Collagen Dressings and Conventional Dressings in Wound Healing study conducted in Manipal university by Dr Harish Rao et al4 concluded collagen dressing is safe and effective in the treatment of foot ulcer and significantly reduces healing time, duration of antibiotic therapy and follow up time.

•Steven A. Kolenik, 111, Thomas W. McGovern, MD, and David J. Leffell, MD[5] A study conducted by Steven et al5 showed the average time to complete granulation with bovine collagen was 3.5 weeks, while the time for complete re-epetheliasization was 6.1 weeks. The control sites were evaluated only for time to complete reepitheliazation (complete healing), and this averaged 9.4 weeks for all 15 wounds. While the collage-matrix –treated wounds healed over 3 weeks faster and in 65% of the time it took the conventionally – treated wounds to heal.

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. To compare standard vs collagen dressings in postoperative abdominal wound dehiscence.
2. To document the outcome of patients with post operative abdominal wound dehiscence.
3. To study the type of incision leadng to wound dehiscence.
4. To study the incidence of wound dehiscence in elective and emergency operation.

7. MATERIALS AND METHODS

7.1 Source of Data

Data shall be collected from all patients with post operative abdominal wound dehiscence, who are admitted and underwent surgery during period of 18 months in which first 9 months collagen dressings will be done where as in next 9 months standard dressings will be done (December 2017 To May 2019 will be taken for study considering the inclusion and exclusion criteria.

7.2 METHOD OF COLLECTION OF DATA

Information will be collected through predesigned pretested proforma for each patient.

•All patients admitted with post operative abdominal wound dehiscence will be interviewed as per the proforma and a complete clinical examination will be done.

•Cases will be allocated randomly into test group and control group, test group treated with collagen dressing and control group treated with standard dressing.

•Cases are assessed for healing time, pain using VAS score, healing quality by assessing wound perimetry, number of dressings and complications in both the groups.

INCLUSION CRITERIA

- Age group between 18 years to 60 years
- Abdominal Wound - Post operative wounds

  -Patients who have developed abdominal wound dehiscence. .

  -Patients who are willing for investigations and treatment.

-All patients who have developed wound dehiscence after any abdominal incision.

-Patients with wound dehiscence having systemic diseases like diabetes mellitus, COPD, and anaemia.

Patients who developed wound dehiscence due to comorbid obesity.

EXCLUSION CRITERIA-

- Hypersensitivity to Collagen
- Age group more than 60 years
- Age group less than 18 years

- . All patients with incisional Hernia.
- All Patients who have developed evisceration
- All patients with wound dehiscence on sites other than the abdomen.
- All patients who refuse investigations.
- All patients who refuse admission and further treatment.

Sample size

50 admitted surgical ward/casuality/ICU patients with post operative abdominal wound dehiscence will be considered for this study. Selection of the patients will be done randomly. Where 25 patients will be selected under Collagen dressing studies and the rest 25 patients will be selected under standard dressing studies. Randomization of cases is done as first 25 cases will be selected for collagen dressings & next 25 will be selected under standard dressings

- **Period of follow-up**

Patients will be followed up on day 1, 3, 7,14 and 1month .All patients will be followed up till the development of complete healthy granulation

OUTCOME Appearance of healthy granulation tissue in wound will be taken as a end of follow-up.

STATISTICAL ANALYSIS

Data were described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test was performed and exact test was used when the expected frequency is less than 5. A probability value (p value)less than 0.05 was considered statistically significant.All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

a) Yes, Complete blood count

b) Wound swab culture

c) X-ray chest

d) FBS/RBS

e) Blood urea, serum creatinine

f) ECG

g) Viral markers

h) LFT, serum albumin

i) Others viz. USG, CT abdomen etc.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith

LIST OF REFERENCES

1. Guben – CFG, Rolon LC, Bond MC. Essential concept of wound management. Emergency medicine. Clin NAM. 2010;28;951–67.
2. Veves A, Sheehan P, Pham HT. A randomized control trial of promogran (a collegen/oxidized regenerated cellulose dressing) Versus standard treatment in the management of diabetic foot ulcer Arch Sug. 2002;137(7);822-7.
3. Donaghue VM, Chrzan JS, Rosenblum BI, Giurini JM, Habershaw GM, Veves A. Evaluation of a collagen-alginate wound dressing in the management of diabetic foot ulcers. Advances in Wound Care : the Journal for Prevention and Healing. 1998;11(3):114-9.
4. Singh O, Gupta SS, Soni M, Moses S, Shukla S, Mathur RK, Collegen dressing versus conventional dressing in chronic wounds: A retrospective study. J Cutan Aesthet sugery. 2011;4:12–6.
5. Rao H, Pai A, Hussein I, Shankar Ram HS, Pai SR, Pai S. A Comparative Study between Collagen Dressings and Conventional Dressings in Wound Healing. International Journal of Collaborative Research on Internal Medicine & Public Health. 2012;4(5):611-23.
6. Kolenik SA 3rd, McGovern TW, Leffell DJ. Use of a lyophilized bovine collagen matrix in postoperative wound healing. Dermatol Surg. 1999;25(4):303-7.
7. Hugh TB. Abdominal wound dehiscence, editorial comment. Aust NZ J Surgery. 1990;60:153-5.

8. Waqer S, Malik Z, Razzaq. Frequency and risk factors for wound dehiscence/burst abdomen in midline laparotomies. Journal Ayub Med Coll. 2005;17:70-3.
9. Mokela JI, Kivviniemi H, Juvonen T, Laitinen S. Factors influencing wound dehiscence after midline laparotomy. Am J Surg. 1995;170:387-90
10. Col C, Soran A, Col M. Can postoperative abdominal wound dehiscence be predicted? Tokai J Exp Clin Med. 1998;23:123-7.

PROFORMA

S.No

Name Age Sex

CR.NO Date of Admission Date of Discharge

Past History

Time of dehiscence from surgery

GPE

BP

Pulse

Respiratory rate

Temperature

Anaemia

Cyanosis

Jaundice

Lymphadenopathy

Pedal edema

Systemic examination:

Respiratory system

Cardiovascular system

Central nervous system

Per abdomen

Investigations:

- Haemogram
- Albumin
- Blood sugar
- RFT

Signature of Candidate **Signature of Supervisor**

- LFT
- BT and CT
- Chest XRAY
- Urine routine

Local examination:

Wound

- Site
- Size
- Depth
- Length
- Width
- Margins
- Base
- Slough +/-
- Granulation tissue +/-
- Periskin healthy/ dirty
- Discharge +/-

Signature of Candidate

Signature of Supervisor

perimetry	*Day1*	Day7	Day 14	Day 28
Length in mms				
Width in mms				
Base				
Margins /edges				
Periskin changes +/-				
Slough +/ -				
Granulation tissue				
Discharge +/-				

Signature of Candidate

Signature of Supervisor

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

.....am willing to participate in the study **"A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____ निवासी _____ इस शोधकार्य **"A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____

गवाह के हस्ताक्षर

नाम:

_____

रोगी के हस्ताक्षर/अंगूठे का निशान

नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"A COMPARATIVE STUDY OF STANDARD DRESSING VS COLLAGEN DRESSING IN POST OPERATIVE ABDOMINAL WOUND DEHISCENCE" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____
ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਪਤਾ _____

_____
ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਪਤਾ _____

_____
ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____
ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ